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Explosives Regulatory Division

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Division de la réglementation des explosifs

Storage Standards for **Industrial Explosives**

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Foreword

These revised *Storage Standards* bring many refinements to those that were initially published in 1972. As in the past, many improvements have been proposed by industry and have been accepted. An obvious one is the addition of Part II, "Storage Operation Principles," which deals with many of the common areas related to magazines that were formerly in the Regulations. The subject matter will look familiar to many in the industry. The addition of Part III, "Rulings and Policy Decisions for Magazines Built before May 31, 2001," has a number of implications for existing magazines to improve security.

These revised *Storage Standards* come into force on May 31, 2001. They update and supersede the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators*.

The Explosives Regulatory Division (ERD) of Natural Resources Canada, in conjunction with the RCMP, has developed and adopted a redesign of the walk-in magazine door to ensure a higher degree of security. This new standard makes the laminated door mandatory for walk-in-type magazines and introduces many barriers to thwart a break-in. The new door concept referred to in this document is to be adopted on all new walk-in magazines immediately upon introduction of this publication on May 31, 2001. For existing magazine installations, it is to be phased in over the next 5 to 10 years as a replacement, with particular emphasis in areas prone to break and enter (B&E) or attempted break-ins.

In the interest of security, ERD has, on the advice of the RCMP, moved from heavy-duty locks to high-security locking hardware and emphasized better key control for magazines. There will be no grandfathering on locking hardware and, thus, licensees will have from three to five years from May 31, 2001, to upgrade to the newer, higher security standards.

Recent ballistic threat assessment tests using readily available ammunition for hunting have resulted in upgrading the wall thickness, particularly for the new Type 4 magazine standards, from 5 cm (2") to 7.6 cm (3") for washed hard crushed gravel and to 15 cm (6") for sand. In most cases, existing magazine wall construction will be grandfathered.

With the publication of this standard, Types 2, 3, 5 and 7 magazines will no longer be permitted as an option for new magazines built after May 31, 2001, due to inherent weaknesses and duplication in the case of Type 7. Existing magazines built to the above designs will need to be replaced with an appropriate magazine over the next 5 to 10 years depending on the risk as determined in consultation with the RCMP Bomb Data Centre and other police authorities.

Type 9 magazines, as known now, will be phased out over a five-year period and be replaced with an updated design with many similarities to a Type 4 magazine.

Type 11 magazine standards have been revised and utilize an ISO container commonly known as a "seacan," which has been upgraded to include the newer door concept with ballistic materials in the walls. This bullet-resistant structure has many of the attributes of the former Type 5 magazine standards plus metal studs in the walls. Magazines built to this standard will have limited use as they are not considered an equivalent replacement for a Type 4 or 4S steel magazine. This standard has been upgraded to reflect the higher sensitivity of UN 1.1D classified explosives stored in northern regions, but may also be considered for use in other parts of Canada to meet particular circumstances.

Type 12 magazine standards have been reworded to allow more flexibility for novel designs related to particular circumstances.

ERD has taken a fresh approach to the electrical classification for magazines, particularly for interior lighting, and recognizes the minimal hazards associated with finished packaged products. Along the same lines, heating guidelines have been included in Appendix C, as has the referencing of Electronic Intrusion Alarm Systems for Magazines (Bulletin #45).

In the past, it has been customary for any welding shop to build a walk-in-type magazine from the published magazine standards. With the publication of these revised standards, the intimate details of the door design will be controlled and issued to "approved" shops or facilities across Canada to maintain consistent quality of construction and to limit the design details to those who have a "need to know." As has been the case in the past, any welding shop will be able to construct the balance of the magazine if it so wishes.

Each magazine will now have a unique code composed of numbers/letters with a corresponding tag installed in the magazine and noted on the licence.

The Canadian *Quantity Distance (Q/D) Principles* have been adopted by ERD and are to be used in conjunction with these *Storage Standards* when siting a magazine. The *Q/D Principles* publication is available in its entirety from ERD for a fee.

Chief Inspector of Explosives

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No longer permitted as an option.

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Part I. Magazine Storage Standards

GENERAL

These *Storage Standards for Industrial Explosives* comprise three parts, namely:

- Part I Magazine Storage Standards,
- Part II Storage Operation Principles, and
- Part III Rulings and Policy Decisions for Magazines Built Before May 31, 2001.

There are circumstances where agreement has been reached between industry and the Explosives Regulatory Division (ERD) to address unique storage and handling practices for a particular situation or industry as a whole. These have led to the development of "Codes of Practice" that will be addressed by additional terms and conditions of a licence and thus may be referred to by reference in this manual.

Throughout this document the *Storage Standards for Industrial Explosives* will be referred to as the *Magazine Storage Standards* or simply the *Storage Standards* or *Magazine Standards*. These *Storage Standards* update and supersede the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators*.

A list of numbered endnotes that appear in this document as (#_) beside wording or titles is found at the end of "Part I. Magazine Storage Standards" with cross-references to the appropriate sections.

Much of what is described in Section 1 for Type 1 magazines is applicable to other magazine types and, where appropriate, is cross-referenced.

The illustrations throughout these *Magazine Storage Standards* are, in most cases, meant to be just that, illustrations of the concepts only.

G.1 Application

G.1.1 Part I of these standards is applicable to the construction of new magazines for the storage of industrial explosives, which can include, but are not limited to, large quantities of propellant powder and black powder, blasting explosives, detonators and explosive accessories, with the latter explosives commonly associated with the construction, mining, seismic, and oil and gas well industries. Anyone who stores explosives or detonators must do so in a structure constructed in accordance with these standards and in such a way that it is theft, weather, fire and bullet-resistant (with some exceptions noted, particularly for the latter).

G.1.2 All applicants for industrial explosives magazine licences are reminded of the provision contained within Section 29 of the *Explosives Act*, which essentially states that nothing in the *Explosives Act* relieves anyone from the obligation of complying with the other provincial

and municipal laws that govern explosives, especially as they relate to possession, storage, handling, sale or transport. Refer to Section 29 of the *Explosives Act* for the legal wording.

Note: Provincial authorities who have jurisdiction for the storage of explosives in mining and quarrying operations have generally adopted and accepted the federal magazine standards into their own regulations for surface applications. Users are urged to consult with the appropriate provincial authorities should there be any concerns.

Before submitting a magazine licence application to ERD, it is in the best interest of the applicant to secure local approval for the establishment of the explosives or fireworks magazine site(s) prior to committing to the location and finalizing any purchase/lease agreements. Local approval is best sought by contacting the municipal law enforcement authority and the Fire Department responsible for the proposed magazine site in order to avoid having your federally issued magazine licence revoked by a local jurisdiction. Refer to Section 3.1.1.3 of the *National Fire Code of Canada*, which states that storage of Class 1 explosives shall be in conformance with the *Explosives Act* and its Regulations.

G.1.3 These *Storage Standards* are to be used in conjunction with the Canadian *Quantity Distance (Q/D) Principles* when siting a magazine near other vulnerable areas. As a result, a buffer zone of land will be required in these vulnerable areas.

G.2 Magazine Design

G.2.1 Magazines for the storage of industrial explosives and explosive accessories shall be bullet-resistant[#1] (with specific exceptions noted throughout), non-combustible construction, theft-resistant, weatherproof and well ventilated. Special provisions are made for magazines for use in seismic exploration, prospecting or similar operations.

G.2.2 Magazines for the storage of detonators shall conform in all respects, except bullet-resistance, to the standard for an industrial explosives magazine; however, the presence of bullet-resistant construction does improve theft resistance.

G.2.3 Structures for the purpose of storing finished, packaged explosives as outlined in these *Magazine Standards* shall be designed, constructed and installed to conform with good engineering practice[#12] as described in the *National Building Code of Canada* and its companion document, the *National Fire Code of Canada*, plus other secondary and tertiary references.

G.2.4 Every dimension given in these standards is nominal.

G.3 Material Specifications

G.3.1 Materials shall possess the essential properties necessary to perform their intended functions in the structure. Materials, unless otherwise specified in this standard, shall conform to the appropriate standard specifications outlined in the *National Building Code of Canada*.

G.4 Size and Storage Capacity of Magazines

G.4.1 The size of a magazine depends of the maximum quantity of explosives to be stored at any one time and the storage method, be it palletized or bulk containers of explosives such as Flexible Intermediate Bulk Containers (FIBC), Rigid Intermediate Bulk Containers (RIBC), etc. Based on this quantity, a minimum volume and floor area are necessary to ensure adequate air circulation within the magazine and to provide for both easy access to and safety in the handling of stock.

G.4.2 The guide used by ERD for calculating the licence limits for large magazines is based on a factor of 1.2 m^2 of floor area for each tonne of industrial explosives. For a quantity not exceeding 250 kg stored in a magazine serviced from the outside, about 25% of the volume of the magazine should be left for air circulation and the handling of stock.

G.4.3 However, notwithstanding these factors, explosives inspectors may order a decrease in licence limits when, in their opinion, air circulation within a magazine or floor space for the selection and safe handling of industrial explosives is inadequate.

G.4.4 A table is provided in Appendix A as a ready reference to magazine size and capacity when submitting an application for a licence.

G.5 Alternative Materials

G.5.1 In the event that any of the materials, such as expanded metal or fire-resistant material, as specified in these standards, are not readily available, information or guidance on acceptable alternatives can be obtained from ERD.

G.6 Electric Lighting/Wiring Systems Classification

G.6.1 Although seldom necessary, it is sometimes desired to install electric lighting in a magazine that is used to store industrial explosives. The *Canadian Electrical Code* (CEC) does not specifically address explosives; however, it does establish requirements for the design and installation of electrical equipment and wiring in locations containing combustible dusts and flammable liquids, vapours or gases that, in general, are comparably hazardous.

From an electrical hazard point of view, there is, in general, a wide spectrum, noted below, for the storage of industrial explosives as defined in the *Explosives Act*. The products could be in-process or simply a finished product or an article packaged and ready for shipment or use. For the purposes of this standard, ERD will apply this standard to a finished product in its finished packaged state such that it does not normally present a hazard from dust or vapours. In such a case, the area lighting shall be classed for a watertight, dust-tight and corrosion-resistant equipment rating (that which would pass a *Canadian Electrical Manufacturers Association/National Electrical Manufacturers Association* [CEMA/NEMA] 4X hose test).

Note: For electrical heating installations, the electrical classification for unit heater and convection heater hardware is Class 2, Division 2 (minimum) - refer to Appendix C.

G.6.2 In all cases, permanent wiring shall be either in aluminum rigid conduit (provides mechanical protection and non-rusting) or plastic-coated flexible armoured cable (TECK 90), with the latter requiring additional mechanical protection, particularly on the vertical walls, to prevent damage from pallets, stacked boxes, etc. Ideally, the wiring should be incorporated within the wall structure. Where feasible, all switch boxes are to be mounted external to the magazine. The entire wiring circuit will incorporate a ground fault interrupter.

G.6.3 Although this publication generally applies to finished packaged goods, there may be occasions where it may apply to explosive product(s) stored in an in-process state and generally exposed. The applicant will need to know the properties of the explosives involved with the minimum requirements, including the sensitivity to heat and spark and their thermal stability. In each case, the lighting surface temperature shall not exceed 80% of the lowest ignition temperature that will sustain a flame for the explosive or ingredient being stored. These areas will need to be evaluated for potential exposure by equipment malfunction, explosive material spillage, and the possibility of ignition sources arising from physical damage to the wiring method used. In most cases, the electrical classification may need to conform to Class II, Division 2 for dusts or to Class I, Division 2 (Class I, Zone 2) if vapours pose a potential problem.

For assistance with in-process products, consult ERD with your detailed plans and recommendations for approval. Failure to do so may result in the magazine being UNACCEPTABLE for licensing and use.

G.6.4 All overhead transmission lines shall stop at least 15 metres from the magazine in order to divert a potential lightning strike and then proceed underground to a preferred entrance on the exterior of the magazine.

At no time is an overhead electrical mast permitted on the magazine.

A master emergency cut-off electrical switch and ground rod shall be installed on or before the last pole of the transmission line.

G.6.5 With the advent of safer, less sensitive explosives, electrically powered forklift trucks and smaller materials-handling pallet movers rated as ES may be used inside magazines when explosives are sealed in their normal external packaging ready for shipment.

Note: An ES-rated electrical unit cannot be used in a manufacturing operations facility and its use will therefore be limited to magazines only.

Electrical charging or the changing of batteries are not to take place within a magazine. Consult ERD and the *Canadian Electrical Code* (CEC) for requirements.

The use of a higher electrically rated EE-powered unit is required for in-process operational environments and will give greater flexibility if it is expected to be used for materials handling in either a magazine or a manufacturing operation.

G.7 Intrusion Alarms and Additional Security Measures[#4] (Bulletin #45)

G.7.1 With the incidences of attempted or successful break and enters in generally high-profile areas, licensees are encouraged to consider additional security measures through the use of physical barriers such as fencing and/or electronic intrusion alarm systems. Although neither is a regulatory requirement at this time, ERD supports such efforts.

G.7.2 An intrusion alarm system consists of electronic components designed and interconnected for the purpose of detecting intruders to ensure the protection of people, property and materials (explosives in this case) and also to allow for an effective response.

Key requirements, amongst others, are:

- no solar panels, and
- no electrical masts or antennas directly on the magazine itself.

The latter has the potential to attract lightning. When installed, at a minimum of 15 metres from the magazine structures, they must have provision for lightning protection, which will include, as a minimum, a ground rod for lightning and surge suppression for the electronics regardless of whether the installation is hardwired for power or stand-alone solar panel powered.

> Note: In all cases, seek the advice of ERD and request Bulletin #45, a guideline on the subject matter, prior to proceeding with the installation.

Bulletin #45 is intended only as a safety guideline for the design and installation of such a system. Each system is unique from a technical point of view and the individual circumstances present. As a result, the installation will require some direct consultation between ERD and the service provider.

For such intrusion alarm system installations, approval is required from ERD for federally approved licences. Failure to obtain approval may result in the magazine being UNACCEPTABLE for licensing and use.

G.8 Heating Systems and Insulation[#11]

G.8.1 With the advent of slurry/watergel and emulsion explosives and work in the far north, the heating of magazines may be permitted. Specific models of gas, oil and electric furnaces, coupled with a circulated heated water/glycol solution or forced hot air systems, have proven satisfactory for general use. Many factors affect the type and capacity of a heating system and thus, one can only give guidelines for such installations. Refer to Appendix C if considering such an installation.

G.8.2 Before installing any heating system (including insulation) in a magazine, submit detailed plans and specifications to ERD for approval. Failure to do so may result in the magazine being UNACCEPTABLE for licensing and use where heating is deemed to be necessary.

G.9 Quantity Distance (Q/D) Principles

G.9.1 In the case of an accident, and to ensure protection from the effects of an explosion, it makes intuitive sense that the more explosives there are, the further away one should be. That is the basic premise for Quantity Distance (Q/D). Donor sites such as a magazine present an obvious risk to persons and property. Donor sites shall be located at carefully chosen distances from each other and from other susceptible sites using the guidelines in the *Q/D Principles* published by ERD. An excerpt from Table 1, titled "Quantity Distances (Q/D) Table for Hazard Division 1.1 & 1.5" explosives is available free of charge from ERD. More complex situations may require much of the background contained in the *Q/D Principles* manual, which is available for a fee.

One should ensure that the required buffer zone (land) is approved by the local zoning authorities and/or agreements are in place with landowners. In addition, one should ensure there are no constraints now or in the future that will render the site unusable.

Prior to siting a magazine, one must discuss and/or submit the proposal to ERD for approval. Otherwise, what is proposed may be UNACCEPTABLE for licensing.

G.10 Mounding/Traversing/Barricades

G.10.1 Effective barricades are capable of stopping high-velocity, low-trajectory projectiles from an explosion that otherwise could cause direct propagation of the explosives at a susceptible site. Additionally, such a traverse may provide some protection for personnel in the lee of the barricade. A mound/barricade may also provide limited protection against blast and flames arising from an external or internal explosion. In many instances, the use of very large Inter-Magazine Distances or Process Building Distances may be avoided, thus providing a significant cost reduction through reduced real estate requirements.

Keep in mind that substantial distance is required when siting for members of the general public or persons not involved in explosives handling. This distance cannot be reduced by mounding with respect to the risk from projectiles.

The reduced quantity-distances are outlined in the *Q/D Principles*. A prospective licensee is advised to reference and/or submit plans to ERD or its provincial counterpart prior to proceeding. Otherwise, the magazine, as located, may be UNACCEPTABLE or severely restricted with respect to the quantity of explosives it may hold.

G.11 Magazine Numbering System (Code/Tag)

Each magazine licenced by ERD will be issued a unique number/letter combination (code). A corresponding non-sparking metal plate (tag) is to be secured on the interior of the magazine in a prominent location, e.g., on the door at eye level, so that it can be readily observed by an explosives inspector. Additionally, the tag number/code is to be permanently identified on the exterior of the magazine door/lid via contrasting colour-painted numbers or stick welded (5 cm suggested) or stamped (2 cm suggested) in a manner that can be readily observed by an explosives inspector upon approaching a magazine from the front.

The magazine manufacturer/fabricator, in most cases, will be responsible for installing the coded tag inside the door and identifying the code number on the outside of the magazine. The magazine owner/client is responsible for notifying the local regional ERD office of the tag number when applying for a magazine licence, which indicates that the magazine has been upgraded to meet these revised standards.

Note: This coded tag is required in addition to other provincially assigned numbered tags.

The magazine number stays with the magazine at all times during its life and must appear on the magazine licence. The notation M-1, M-2, etc., mentioned on licences will be replaced with the new code number.

G.12 Lightning Protection

In most cases, protection against lightning is currently not a requirement under these *Storage Standards* and thus is left to provincial authorities. Exceptions may apply for in-process sensitive explosives storage in facilities licensed by ERD, particularly where there is a high incidence of lightning strikes (flash density/square kilometre) and advice should therefore be sought. The *National Fire Protection Association (NFPA) Standard 780* titled "Standard for the Installation of Lightning Protection Systems," Appendix H - Risk Assessment Guide, is recommended as a reference to commence a hazard review for such facilities. If a system is required, it must be installed according to CAN/CSA standard B72-M87 and the *Lightning Rod Act* endorsed by the provincial fire marshal's office in each province or territory.

G.13 Approved Fabrication Shop/Facilities

ERD has embarked on a program to control the release of the magazine door drawings to fabrication shops in order to maintain a consistent quality of construction and to limit the design details on a "need to know basis."

The process involves a three-part application, security and certificate agreement that an interested party must apply for through ERD headquarters in Ottawa, Ontario. There is a fee associated with the release of the drawing package.

SECTION 1 – TYPE 1 MAGAZINE

(Reinforced Concrete Block)

1.1 Uses

1.1.1 Magazines built to this standard are suitable for use as permanently located magazines for the storage of industrial explosives as noted in subsection G.1.1.

1.2 Basic Construction

1.2.1 This walk-in-type magazine shall be constructed from hollow concrete blocks with additional metal reinforcement and continuous grout fill for security. The walls shall be sufficiently thick to resist the residual energy of readily available hunting ammunition and will be referred to as "bullet-resistant walls" in this text. Refer to Illustration 1.

1.3 Materials

1.3.1 Concrete blocks shall be hollow concrete brick units and provide a wall thickness of 20 cm (50% void). Pre-assembled hollow (25% void) concrete panels of the same thickness may also be used.

1.3.2 Mortar and grout shall be of the following proportions by volume, grout being mortar of pouring consistency:

- 1 masonry cement plus 1 Portland cement with 4½ to 6 parts of mortar sand in damp loose condition;

OR

- 1 Portland cement plus 1/4 hydrated lime with 3 to 6 parts of mortar sand in damp loose condition.

1.3.3 Metal reinforcement bars to a minimum of 10 mm in diameter for vertical wall reinforcement and steel wire for horizontal layering between each course shall be cold-rolled steel.

1.3.4 Lumber shall conform to at least the minimum grade for the specific end use.

1.3.5 Plywood shall be exterior fir ply type. Faces exposed on the interior shall be good one side (GIS). Particle board is not acceptable as being equivalent to plywood.

1.3.6 Metal plates and shapes shall be mild steel unless otherwise stated.

1.3.7 Metal reinforcing for roof, exposed wood trusses/rafters and wood floors shall be covered by 8-mm Short Way Dimension (SWD) opening, 18-gauge (5/16"-18) standard expanded metal; for ventilator openings it shall be 5-mm SWD opening, 20-gauge (3/16"-20) flattened expanded metal.

1.4 Foundation

1.4.1 A well-drained concrete slab foundation is preferred. Such slabs shall be laid according to established practice in the trade, but a minimum of 10 cm of compacted granular material shall be provided underneath the slab and the minimum thickness of the slab shall be 10 cm exclusive of topping. Reinforcing bars shall be securely embedded vertically in the foundation around the perimeter on a 30-cm spacing extending one half of a metre above the finished floor slab and physically tied into the wall-reinforcing bars by welding.

1.4.2 If a concrete slab foundation is to be used as the floor, the sill of the door frame (refer to subsection 1.7) shall be embedded in it. The slab shall be finished with a topping at least 20 mm thick and be level with the door stop.

1.5 Walls

1.5.1 Assembly with pre-assembled concrete block panels shall conform with good engineering practices such as described in the *National Building Code of Canada* and in the manufacturer's recommendations.

1.5.2 The walls are to be constructed of hollow (50% void) concrete block with metal reinforcing bars spaced on 30-cm centres and run continuously for the full height of the wall. To facilitate laying concrete block, courses shorter than full-height reinforcing bars may be used provided they are welded together to form a continuous run to the full height of the wall. Each core shall be continuously filled with grout. All grout shall be consolidated at the time of pouring. Bond shall be provided by lapping blocks in successive vertical courses and with steel-wire reinforcement laid between each course and around corners (refer to Illustration 1). Mortar joints shall be at least 12 mm thick. The upper perimeter of the wall shall be finished level or the sloped sides shall be continuous mortar. Anchor bolts or other secured method shall be embedded at least 10 cm in the mortar of the top course of concrete blocks and used to secure the roof.

FOUNDATION AND WALLS

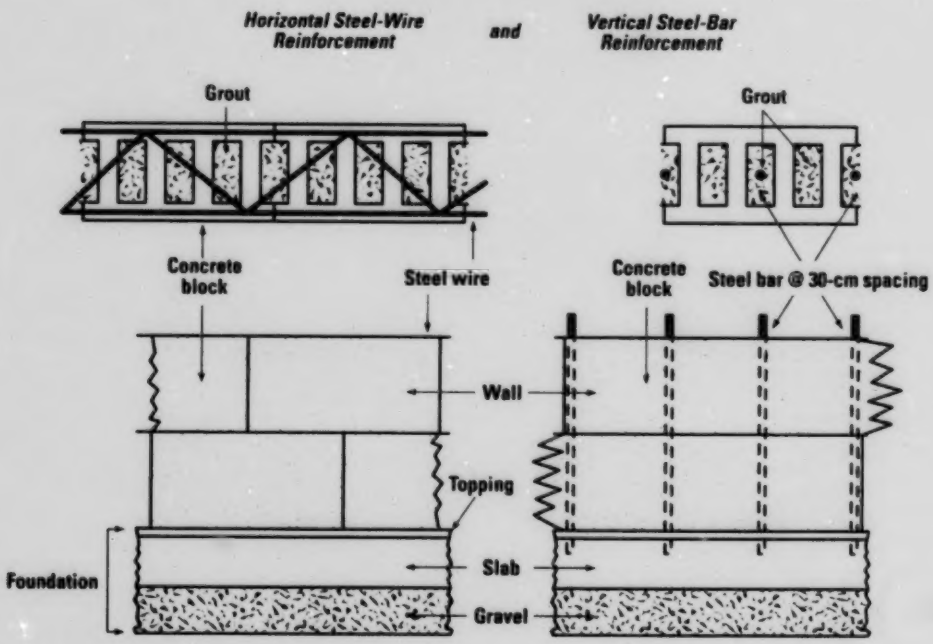


Illustration 1. Typical foundation and wall design for a Type 1 magazine.

Note: Both steel wire between rows and steel rebar @ 30-cm spacing are required.

Where roof trusses or rafters are incorporated into the walls, these must be blocked solid between the truss or rafter ends, i.e., continue the wall, and the ends must be parged after having extended the roof's expanded metal mesh over the truss or rafter ends for added security. Tie the truss or rafter ends into the block using proper ties (refer to subsection 1.9.2 - Roofs).

1.5.3 The door(s) and ventilators shall be the only openings into the magazine.

1.5.4 To control moisture, it is recommended that the outer walls be sealed with a vapour-barrier-type concrete paint or sealer.

1.6 Door Lintel and Sill Plate

1.6.1 The door lintel and sill plate shall be a minimum of 6 mm x 150 mm metal plate overlapping the walls on each side of the door by at least 30 cm; they shall be securely fastened to the top of the wall and the floor, or anchored in a joint between courses of concrete blocks.

Alternately, a 200 mm x 60 mm channel could be substituted, embedded and anchored for both the door lintel and sill plate (refer to subsection 1.7.3).

1.7 Door Frame and Sill

1.7.1 The door frame shall be fabricated from two 6 mm x100 mm x100 mm angle irons continuously welded to form a channel or from a 200 mm x 60 mm x 6 mm channel and anchored into the walls. A door stop of 25-mm-square, steel bar stock shall be welded to the top and both sides of the door frame after the door has been temporarily installed to account for any warpage in fabrication. A similar 25-mm-square, steel bar stock is to be used for the door stop at floor level and incorporated with the sill plate (refer to subsection 1.4.2 above).

1.7.2 The door side frames shall be securely fastened to the door lintel and sill plate by welding or by 12-mm-diameter, counter-sunk machine bolts. The space between the door frame and the wall shall be filled with grout.

OR

Alternately, the door frame, lintel (header) and sill could be constructed of angle iron as described above, such that the completed frame overlaps the concrete block and foundation walls. The space between the door frame (jambs) and the wall shall be filled with grout after having ensured the entire frame is anchored to the walls, etc.

1.7.3 Frame distortion and subsequent door warpage have been noted from extreme temperature cycling and magazine settling following field installation and thus may aid a forced pry attack. To minimize such an attack, a 6 mm x 25 mm x 25 mm angle iron can be field installed by welding on the exterior of the door frame. One leg of the angle would be perpendicular to and mounted close to the door opening. If necessary, the angle iron can be positioned on three sides of the door opening (not the hinge side).

A preferred method is to build up the exterior of the frame with flat stock so it is flush with the door and thus compensates for the door warpage.

1.8 Floor[#2]

1.8.1 The floor shall be a solid concrete slab (refer to subsection 1.4.2) or constructed of thick wood (refer to subsection 1.8.3).

1.8.2 Concrete floors shall be finished smooth and sealed. The finished floor shall be level with the bottom door stop.

1.8.3 If wood floors are to be considered, they shall consist of a sub-floor constructed of two opposing layers of lumber 5 cm square (or one layer of standard mill size, i.e., 5 cm x 10 cm lumber, laid side-by-side on edge) fastened together at 40-cm intervals, staggered top and bottom. On top of this sub-floor a layer of 20-mm plywood shall be added and either nailed with plated sheathing nails or fastened with countersunk plated or non-sparking wood screws. The finished floor shall be level with the bottom door stop. An alternate durable non-sparking surface, such as aluminum tread plate, suitable for rolling materials-handling equipment, may be acceptable, as well as shiplap hardwood highway trailer flooring.

1.8.4 Where there is a crawl space beneath a wood floor, expanded metal shall be laid between the wood sub-floor and the plywood overlay and securely fastened to the sub-floor.

1.9 Roof

1.9.1 The roof shall be of tongue and groove (T&G) lumber 5 cm thick over which is firmly fastened a layer of expanded metal followed by a layer of 12-mm plywood nailed with sheathing nails.

OR

Alternatively, the roof shall be of two layers of 20-mm T&G or shiplap sheathing plywood, sandwiching a layer of expanded metal. The layers of plywood shall alternate direction in order to provide an overlapping of joints. Nailing must be firm.

Note: If installing a commercial roof ventilator, the expanded metal screen must run continuously across the roof opening (refer to subsection 1.11.5).

Metal reinforcing in the roof shall be 8-mm Short Way Dimension (SWD) opening, 18-gauge (5/16"-18) standard expanded metal as outlined in subsection 1.3.7 (refer to Illustration 2).

1.9.2 The roof shall bear on the top of the wall and be securely fastened to it by anchor bolts embedded in the wall or by other methods, provided the roof is secure against prying forces applied from the exterior. The roof should have a minimum of overhang.

If rafters are used, the ends may be embedded in the top course of concrete blocks of the walls and be anchored by straps or other means with the exposed ends covered by expanded metal continuous from the roof (refer to Illustration 3). If the rafters are laid on top of the wall, the ends shall be blocked and reinforced by the expanded metal continuous from the roof. Similarly, if trusses are used for longer open spans within, continue the block course between the truss ends, i.e., continue the wall. Tie the truss ends into the block using appropriate ties and extend the roof's expanded wire mesh over the truss ends for added security and parge the ends to conceal all of the wood.

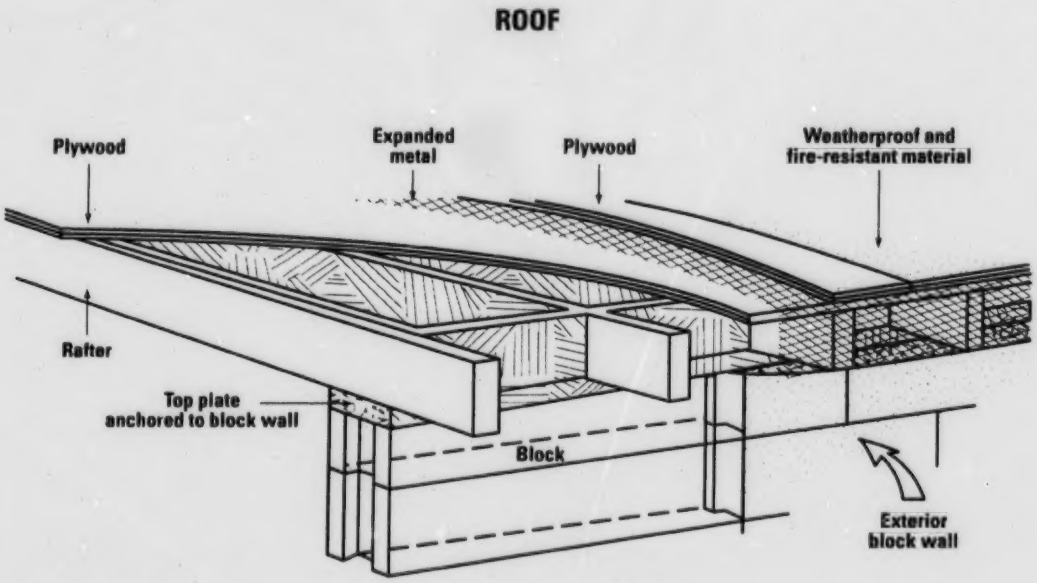


Illustration 2. Typical roof construction for Type 1 magazine.

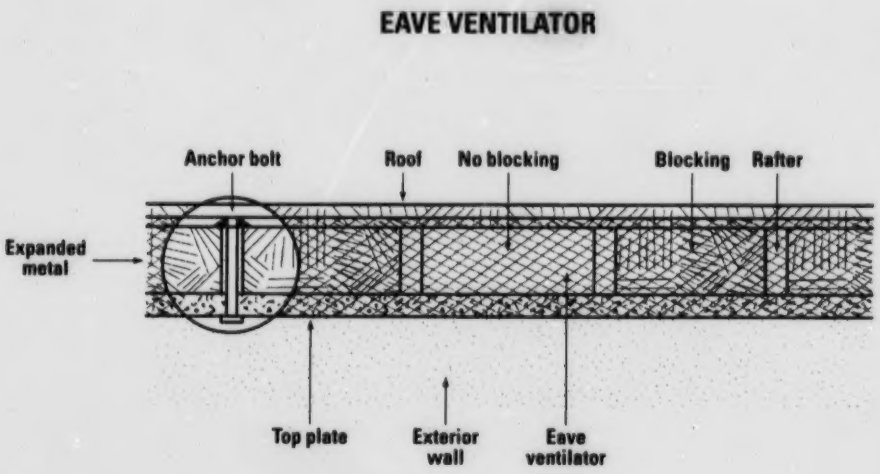


Illustration 3. Typical eave ventilator design.

1.9.3 The roof shall be weatherproofed and fire-resistant in conformance with good fire protection engineering practice.

1.10 Doors(s), Lock(s) and Hinges

Notes:

- The fabrication of the swing-type door itself and release of the detailed drawings will be controlled and issued to approved shops or facilities as determined by ERD on a "need to know basis." An application package is available upon request from ERD for interested parties. There is a fee for the release of the drawing package (refer to Section G.13 for details).
- This document comes into force on May 31, 2001, at which time the new swing door must be installed in all new walk-in-type magazines (and similarly designed smaller Type 4S versions) with an exception noted for Type 6 cupboard-style doors.
- Refer to subsection 1.10.5 for sliding door installations.

1.10.1 Doors - General: Walk-in-type magazines may have either a swinging or a sliding door, but either type shall have an approved locking system (refer to subsections 1.10.4 and 1.10.5).

A large-capacity magazine, with the approval of ERD approval, may have more than one door, but only one shall open from the outside. The second door(s), with no access from the exterior to the interior of the magazine, must have similar security and ballistic characteristics designed into it/them, as is required for swing doors, but be secured on the interior by hardware not subject to a direct attack from the exterior and be of sufficient design strength to withstand both a push or pull attack.

1.10.2 Door Concept:

Note: The nominal size of materials selected for the door and locks has, in most cases, been purposely left out of the following descriptions.

The hinged swing door design consists of a laminated steel structure for enhanced ballistic resistance and a sliding lock bolt train that secures the door at three points along the door jamb. The door is stiffened with angle iron around the interior perimeter to minimize warpage. There are a number of force- and torch-resistant characteristics built into the design, including the traditional 6.35-mm (0.25") safety strap over the lock assembly itself (refer to subsection 1.10.8).

The door jamb consists of bar stock to which the sliding bolt mechanism is secured behind. The hinges are a heavy-duty #5 institutional design (refer to subsection 1.10.12) suitable for the heavy door application. High-security deadbolt locks and cylinders have been incorporated. An outside weather protective hood is incorporated over the lock entry.

The door concept is shown in Illustration 4.

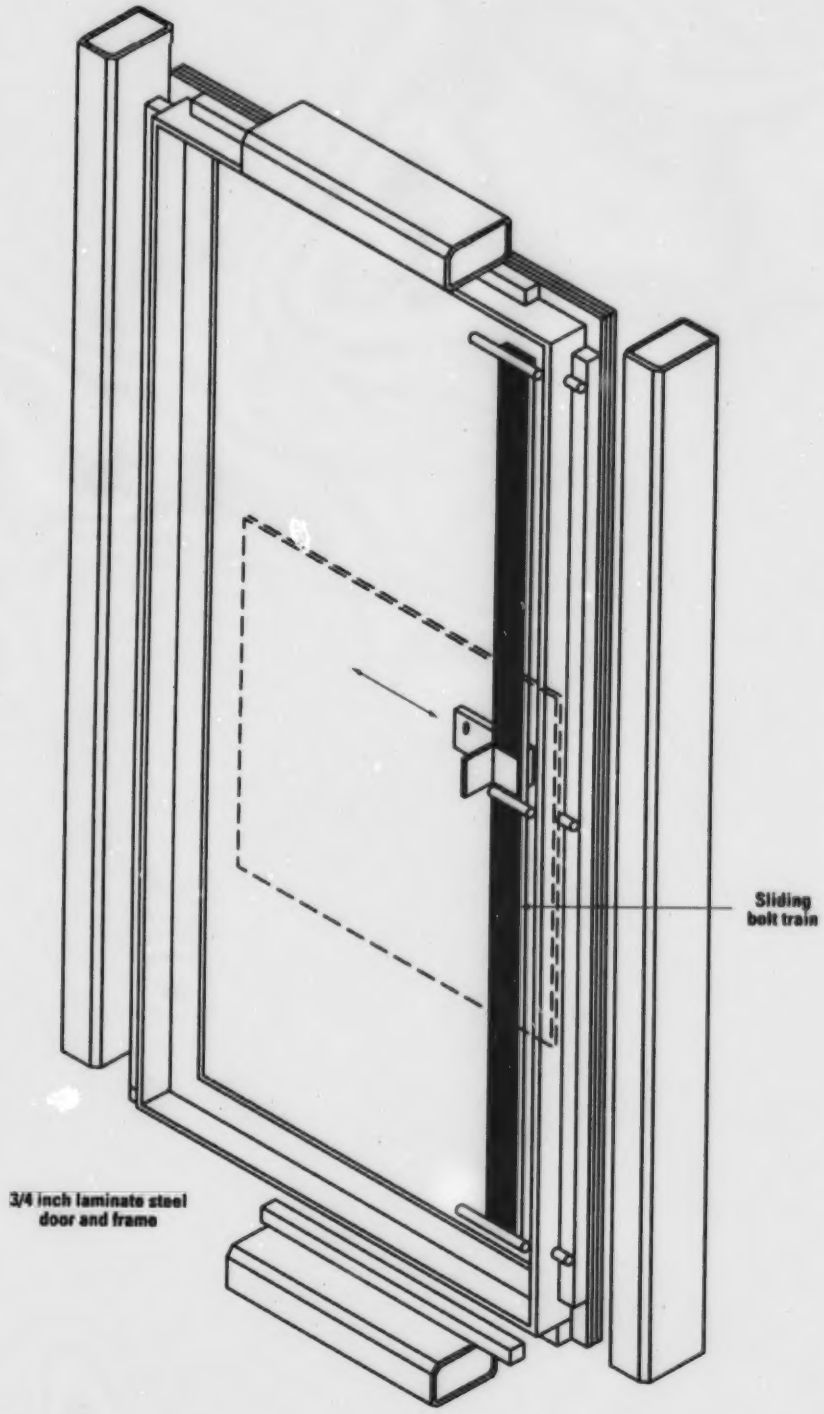


Illustration 4. Typical walk-in magazine door for Types 1 and 4 magazines.

1.10.3 General Door Construction: The laminated door shall be fabricated from two metal steel plates separated by a fire-resistant material, e.g., bonded refined cement and wood or fibreglass commonly known as "backer board" in the construction trade.[#11] A torch-resistant plate is also incorporated into the laminated design. The two steel plates shall be securely fastened together. The edges of the main plates shall be welded continuously around the perimeter and ground smooth to ensure a maximum clearance of 3.05 mm (0.12") between the top, bottom and two sides of the door and the door frame.

During fabrication, caution must be exercised to ensure a finished door with minimal warpage. To facilitate this, an angle iron frame shall be installed around the inside perimeter to stiffen the door. The hinge side of the inner face of the door shall be equipped with an angle iron that will nest behind the bar stock installed on the door frame (refer to subsection 1.7.1) when the door is closed.

The inner surface of the door must be lined with exterior fir plywood (GIS) firmly fixed in place with the good side exposed to the inside of the magazine. Refer to illustrations 12 and 13.

1.10.4 Swing Door Installation: The door shall swing outwards (the hand could be either left or right) and the outer face shall be recessed approximately 9.5 mm (0.37") from the face of the door frame to take into account the curvature of the tubular frame corners used in a Type 4 magazine application. If channel or angle iron framing is used, as called for in subsection 1.7.1 for a Type 1 magazine, then the outside surface of the door is to be flush with the framework.

The door shall be hung on a minimum of three extra-heavy-duty #5 institutional hinges[#11] capable of supporting the excessive door weight (refer to subsection 1.10.12).

> Note: The hinges shall be welded to the door and the door frame so that there remains not more than 3.05 mm (0.12") clearance between the door (top, bottom and sides) when the door is closed.

1.10.5 Sliding Door Installation: Sliding doors and their locking mechanism are often unique but, ultimately, the design must have similar security measures, e.g., force (push/pull/pry), drill, punch and torch characteristics, as well as ballistic resistance characteristics, designed into them, as is required for swing doors. The fabricator/licensee must demonstrate the above has been met and submit the design to ERD for approval prior to commencement of construction (refer to subsection 1.10.6 note on Lock[s]). Failure to do so may result in the magazine being UNACCEPTABLE for licensing and use.

For a sliding door, the basic construction will consist of a laminated steel structure/fire-resistant material similar to the fire-resistant material described in subsection 1.10.3.

The width and height of sliding doors shall be greater than the opening. The track and hardware shall be of extra-heavy-duty type. The tracks shall be installed either on the inside of the building or recessed in a wall pocket with the top and bottom tracks appropriately secured and lagged with bolts and/or anchors. The bottom track shall be recessed in and incorporated as part of the floor/sill plate. The bottom edge of the door shall be contained within the bottom track

with a minimal clearance to preclude a pry attack to force the door off the top track. Steps shall be taken to prevent the entry of driving rain or blowing snow around the edges of the door.

1.10.6 Lock(s):[#4, 5] For walk-in-type magazines, the deadbolt lock shall have a high-security heavy-duty rim or mortise lock cylinder with hardened inserts coupled with a minimum 25-mm (1") throw deadbolt.

Note: No padlocks are permitted unless otherwise specified.

A list of locks known to meet these requirements is provided in Appendix B. The service of a certified master locksmith is recommended when selecting and installing any lock.

Note: Locking configurations for sliding door installations will need to be submitted to ERD for approval prior to installation.

1.10.7 Lock Cylinder(s) and Key Control: [#5] In order to minimize unauthorized entry, it is very important to initiate a key control procedure as described in "Part II. Storage Operation Principles" (subsection 5.0) of this manual and in the Remarks section in Appendix B of this part. Restricted keyways means there are controls on their duplication and availability. As a result, keys and keyways must meet the following conditions:

- Locking devices shall have at least six pins and will include anti-drill, pick-resistant and by-pass-resistant design features.
- Keys must not bear any direct or indirect coding and should have erratic key bitting, i.e., key code 152749 or 416381.

Most locking devices in Appendix B are known to meet these requirements and thus will have restricted keyways. Again, a certified master locksmith is recommended.

1.10.8 Lock Installation[#6] **and Safety Strap.** A typical rim-mount lock and safety strap are shown in Illustration 5. The following conditions shall apply to such installations:

- The body of the lock must fit snugly between the channel and the safety strap.
- The protective lock safety strap must be a minimum of 6.35 mm (0.25") thick and be the full width of the lock, including the extension over the lock bolt in its thrown position.
- The deadbolt must engage with the cam assembly a minimum of 12.7 mm (0.5").
- The rim-mount deadbolt lock must be on the inside of the door.

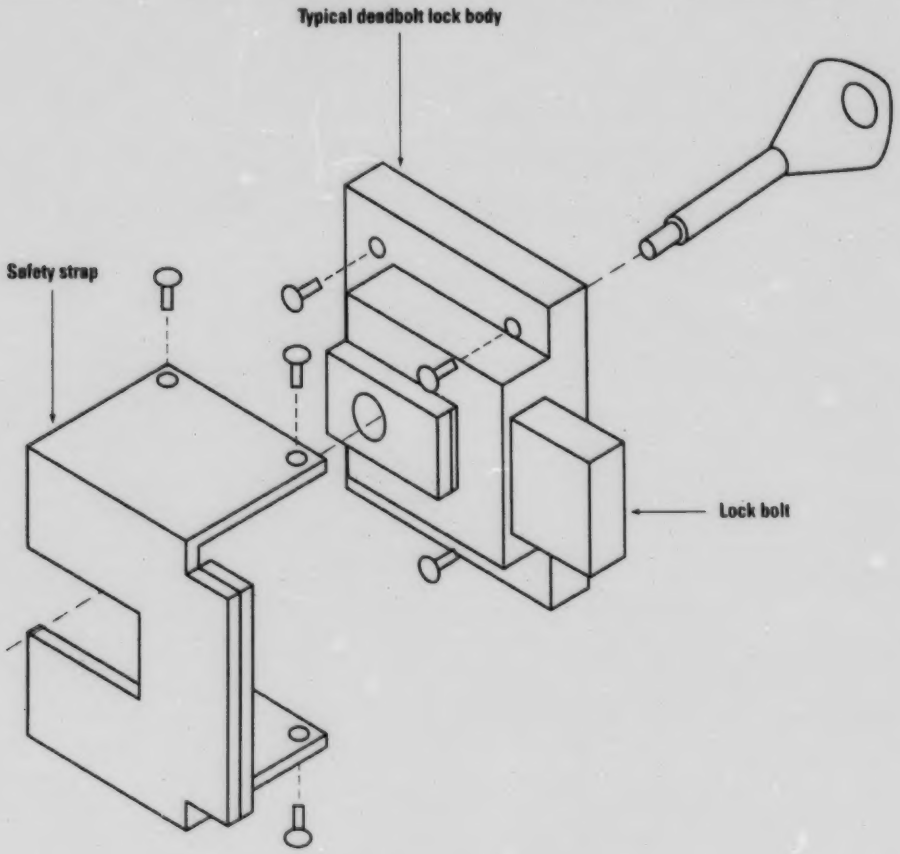


Illustration 5. Typical lock assembly (exploded view).

1.10.9 Lock Weather Protector(s)/Hood:[#6] Each lock keyway and operating handle (by design is weakened) shall be protected by a weather cover plate. The weather protective lock/hood cover should be fabricated from 3.17-mm (0.125") metal plate with a bend at the top to allow for ease of hand and key insertion. A set angle of approximately 35° to the door is recommended (refer to Illustration 6).

> Note: To preclude its use as a point of attachment for a direct pull attack, the hood is to be tack welded only at the corners with a silicone bead used to weather seal the joint between the outside door face and the lock weather protector.

This latter weakening of the lock hood (weather protector) applies to all walk-in-type magazines or similar installations with high-security rim-mounted deadbolt and lock cylinder systems. The horizontal centre line of the keyhole should be about 8 cm above the opening at the bottom of the lock weather protector/hood.

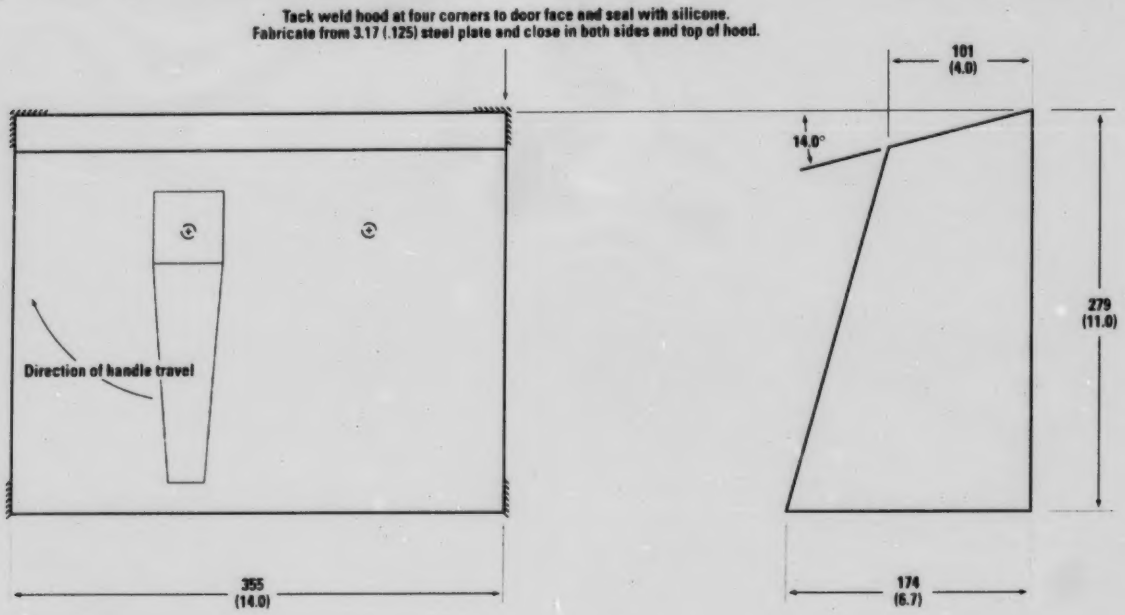


Illustration 6. Typical weather protection lock hood for Types 1 and 4 magazines.

1.10.10 Position of Lock(s): On swing doors, the lock[#6] shall be installed as per detailed drawings issued by ERD to approved fabricators.

Note: Quebec Statute requires two locks, both of which must be employed at all times.[#7]

Magazines designed and installed with two locks and used outside the province of Quebec must have both locks operational and in use at all times unless exempted by an explosives inspector. If one lock is removed, then the dominant lock incorporating the drive mechanism must remain in use at all times.

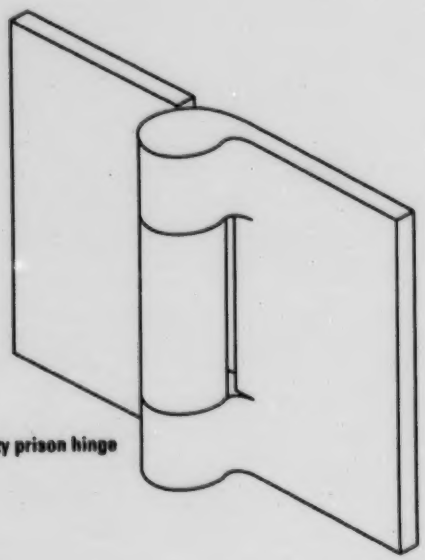
Locking configurations for sliding door installations will need to be submitted to ERD for approval prior to installation (refer to subsection 1.10.5.).

1.10.11 Door Clamp/Wedge: To relieve the weight of an unevenly mounted door, a clamp or wedge may be used. Such a clamp shall not be mounted on the door but, rather, on the magazine wall to prevent its use as a point of purchase in a direct pull attack. An inclined plane type of wedge is recommended. Refer to subsection 4.16 for transport mode locking.

1.10.12 Hinges: The hinges shall be a high-capacity #5 "institutional" prison hinge[#11] capable of supporting the heavy weight of the door, which in many cases will exceed 450-500 kg. A minimum of three (3) hinges are required for a walk-in-type magazine. For wider and heavier doors, four (4) hinges are recommended. Refer to Illustration 7.

Note: Hinges fabricated by machine shops that are not in the business of fabricating such hinges are not permitted to be used, i.e., no homemade hinges are permitted.

Hinges designed to institutional standards have non-removable pins (welded caps over the ends of the barrels) and come preassembled with bearings and hinge pin components to significantly reduce wear and friction. Hinges are generally factory lubricated with many having provision for forced lubrication with grease at a later date. The hinge (leaf) is to be welded in place.



#5 Heavy-duty prison hinge

Illustration 7. Typical heavy-duty "institutional" hinge with non-removable pin, suitable for Types 1 and 4 magazines.

1.11 Ventilators

1.11.1 General: Ventilators shall be provided to ensure that the interior of a magazine is kept dry and as cool as possible. The number and type of ventilators required will depend on local climatic conditions (which are impossible to generalize) and the size of the magazine but, in any case, shall be of, or a combination of, the following approved types and sizes.

Note: A minimum ventilation area of 50 cm^2/m^3 of magazine volume is a useful guide.

Ventilation must be provided above the stacking line as well as near the floor level to promote good air circulation.

1.11.2 Offset Ventilators: These are double-elbow ventilators made of pipe 10 cm in diameter. The two right angles turn within the thickness of the wall so that the opening on the outside is lower than that inside. Any space around the pipe in the thickness of the wall shall be filled with mortar and grout. The outside opening shall be covered by flattened expanded metal welded to a metal frame (refer to subsection 1.11.6). The frame shall be secured over the opening by bolts passing through the walls. The inner opening shall be covered in a similar manner using lag screws and anchors on the interior walls. A flyscreen is recommended (refer to Illustration 8).

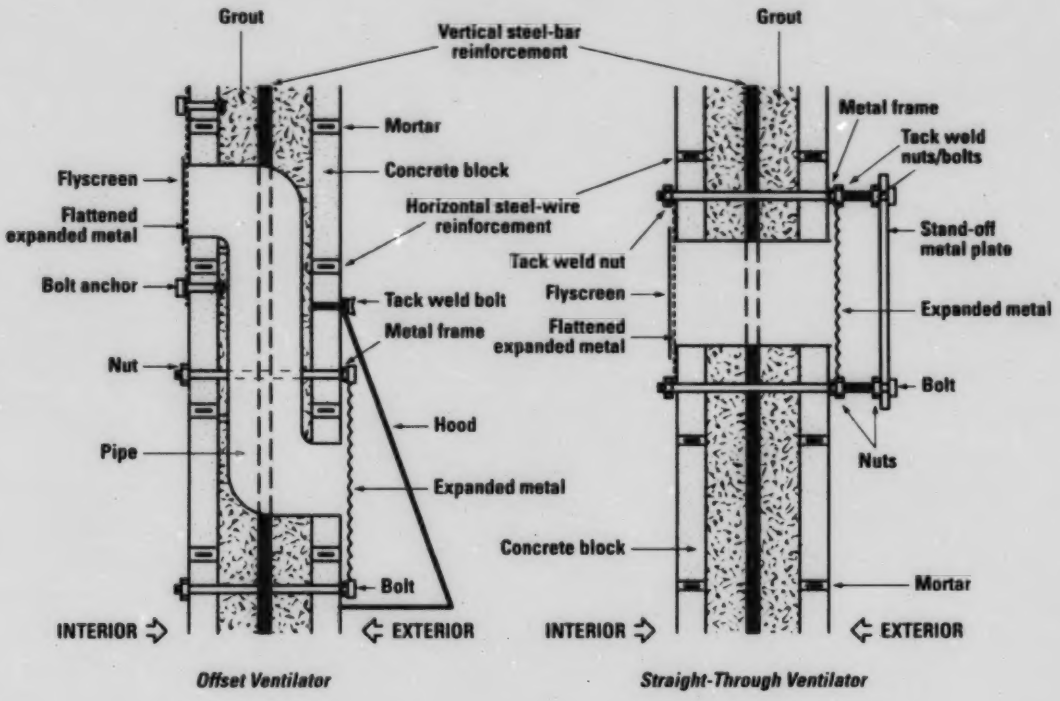
1.11.3 Straight-Through Ventilators: Such ventilators shall not exceed 15 x15 cm and shall be protected by a stand-off metal plate at least 12 mm thick and twice the dimensions of the opening, positioned not more than 8 cm from the wall. Care must be taken to ensure that the integrity of the metal bars or of the wire reinforcing in the wall is maintained. The stand-off plate shall be securely held in position by four bolts 12 mm in diameter anchored to the inner face of the wall. The plate may be sloped to form a hood. The outside and inside openings shall be covered by flattened expanded metal welded to a metal frame (refer to subsection 1.11.6). The frame shall be secured over the openings by bolts passing through the walls. The bolts shall not be the same as those securing the stand-off plate and, in all cases, must be tack welded in place. A flyscreen is recommended (refer to Illustration 9).

1.11.4 Eave Ventilators: If rafters have been used in the construction of the roof, eave ventilators may be installed by dispensing with the blocking between some rafters, provided the opening does not exceed 10 cm in width. The exterior opening shall be covered with the expanded metal from the roof (refer to subsection 1.9.1). A screen fabricated of flattened expanded metal welded to a metal frame shall be installed over the interior opening. If needed, a flyscreen may be installed (refer to Illustration 3).

1.11.5 Roof Ventilators: Various styles of roof ventilators are available on the market. They may be used provided any opening in the roof does not exceed 20 cm in diameter and is protected by two X-bars of 12 x 35-mm steel welded or otherwise firmly fastened across the opening. To avoid water infiltration, the vents must be mounted on boxes. The boxes are to be constructed as per typical roof construction with expanded metal screens running continuously across the opening as described in subsection 1.9.1 - Roofs. In addition, a welded cage fabricated of expanded metal and 6-mm angle iron shall be firmly mounted over the ventilator and fixed to the roof (refer to Illustration 10).

For the interior, the ventilator openings shall be 5-mm Short Way Dimension (SWD) opening, 20-gauge flattened expanded metal.

TYPICAL VENTILATORS



Illustrations 8 and 9. Offset and straight-through ventilator installation for concrete block walls.

ROOF VENTILATOR

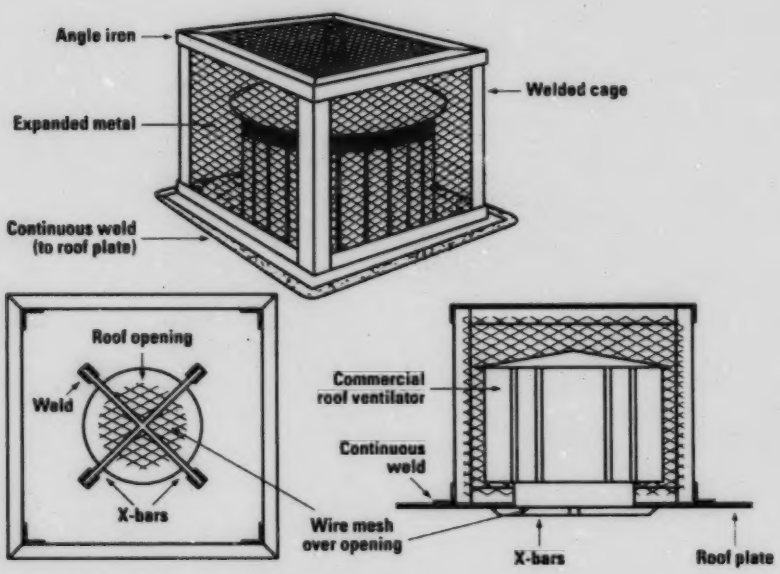


Illustration 10. Typical roof ventilator design.

1.12 Stacking Line

1.12.1 On the interior walls of the Type 1 reinforced concrete wall magazine shall be painted, or otherwise permanently marked, a red line 10 mm wide at a distance of at least 15 cm below the ceiling. This line indicates the maximum height to which explosives may be stacked. Lower stacking heights may be dictated by provincial or other regulations.

1.13 Interior Finish

1.13.1 To provide air circulation and to prevent cases of individual explosive boxes being stacked directly against the walls, 25 x 50-mm furring strips shall be fastened to the usable portions of the walls, vertically on 30-cm centres starting 15 cm from floor level and shall be continuous to the stacking line. As an alternative, it is permissible to install a 5 x 15-cm hardwood skirt at floor level, around the perimeter of the magazine, for the stand-off of palletized product.

For detonator magazines, wooden shelves for part cases or inner packages are preferred. Any exposed ferrous metal, particularly around the doors, that could accidentally be struck during the handling of explosive material shall be covered with wood or otherwise protected.

1.13.2 The use of duckboards, pallets or loose battens on the floor surface will improve air circulation, control of moisture, and cleanliness (refer also to subsection 1.11.1 - Ventilators).

1.14 Exterior Finish

1.14.1 An eavestrough shall be installed immediately over the entry door and extended well beyond each side of the door. An extension of 15 cm (6") is recommended on each side of the door. It must be fully welded (not tacked) to the lintel along its full length to prevent or minimize any rainwater run-off or melting snow from eventually working its way into the door-locking mechanism and between the door and frame.

> **Note: This is particularly critical during the freeze/thaw cycles experienced in the spring and fall in most parts of the country. If not followed, it has the potential to temporarily jam the lock mechanism.**

SECTION 2 - TYPE 2 MAGAZINE
(15-cm Stud-Frame)

2.1 Type 2 magazines built to the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators* will no longer be permitted as an option for new magazines commencing May 31, 2001. Refer to Part III, Section 3.0, for the phase-out period of existing magazines.

SECTION 3 - TYPE 3 MAGAZINE
(10-cm Stud-Frame)

3.1 Type 3 magazines built to the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators* will no longer be permitted as an option for new magazines commencing on May 31, 2001. Refer to Part III, Section 3.0, for the phase-out period of existing magazines.

SECTION 4 - TYPE 4 MAGAZINE
(Metal Plate)

4.1 Uses

4.1.1 Magazines built to this standard are suitable for use as permanently located (usually walk-in-type) or portable magazines for the storage of industrial explosives.

Much of what is stated for a Type 1 magazine with respect to the metal fabricated components such as the door, locks and hinges, etc., is referenced and applicable to a Type 4 magazine.

There are two versions: one generally described as the larger walk-in-type magazine known as a Type 4 magazine, and a smaller version known as a Type 4S, which differs only in door height, the number of hinges, and door-stiffening angle iron.

Notes:

- With the exception of the province of Quebec,[#3] Type 4 magazines can be fabricated in two ways, i.e., with ballistic material in the walls or without. Type 4 magazines fabricated WITHOUT bullet-resistant materials in the wall may only be used for the storage of detonators (refer to subsection G.2.2).
- Magazines built with NO bullet-resistant materials in the walls must be identified with the letter "D" to represent detonator storage only on the licence opposite to the magazine type. In addition, the letter "D" must be shown in a prominent location, e.g., on the inside of the door and on the outside of the magazine as part of the magazine code/tag system of identification (refer to Section G.11) so that it can be readily observed by an explosives inspector.

4.1.2 The formation of missiles in the event of an accidental explosion of the contents is an unknown factor, not readily determinable. For special considerations in locating magazines on factory sites, in complexes containing numerous magazines, or in populated areas, refer to the *Q/D Principles*. For such locations, Type 1 magazines with their structural reinforcement are preferred.

4.2 Basic Construction

4.2.1 Type 4 and Type 4S magazines are fabricated from 6-mm metal plate. The walls shall contain at least 7.6 cm of bullet-resistant material (refer to subsection to subsection 4.1.1, and to 4.11 for exception), and the roof must be 4.7-mm or heavier metal plate.

4.3 Materials

4.3.1 Metal plates and shapes shall be mild steel unless otherwise specified.

4.3.2 Plywood shall be exterior fir ply type. Faces exposed on the interior shall be good one side (GIS).

4.4 Foundation

4.4.1 All magazines shall be mounted on large metal I-beam skids giving a minimum ground clearance of 10 cm or more for structural rigidity and portability.

The whole structure can be raised to truck dock height to facilitate loading and off-loading by mounting the magazine, for example, on concrete highway dividers, steel A-frames or earth mounds.

Notes:

- No structural wood support is permitted under the magazine.
- Magazines built to these standards will, in all likelihood, be moved/relocated several times during their life span and, as a result, are subjected to substantial stresses from the actual move, be it lifted onto flatbed trucks, towed over rough terrain, or seasonal cycles including frost heave. Such torsional stresses can lead to a poor door fit or jamming and weld cracking.

Torsional stresses can be minimized with larger I-beams, additional sub-floor supports and welding techniques as outlined in CAN/CSA-S16.1-94 *Limit States Design of Steel Structures*, and good engineering practice as outlined in the *National Building Code of Canada*. The size and number of these structural members are left to the fabricator/designer to incorporate into the magazine.

4.5 Framework and Walls

4.5.1 The walls shall be fabricated with continuously welded seams from 6-mm or more metal plate. Corner seams shall be welded both inside and outside to ensure complete penetration and increased strength required for lifting of the entire structure. Rolled external corners are recommended for structural integrity.

Lifting lugs are often required to support the substantial weight of a portable magazine (with or without bullet-resistant material) during a relocation.

Notes:

- Lifting points must be designed by a professional engineer using good engineering practice as outlined in the *National Building Code of Canada* and welding techniques as outlined in CAN/CSA -S16.1-94 *Limit States Design of Steel Structures* (refer to subsection G.2.3).
- Internal support bracing for the walls and roof is strongly recommended when transporting any large magazine.

Metal "I" and "U" channels or angles of 7.6 cm (3") or greater depth shall be fastened at suitable vertical intervals around the interior walls. When required for structural rigidity, these channels/angles may be used as the framework.

The walls shall be filled with bullet-resistant material as outlined in subsection 4.11 (refer to Illustration 11).

Notes:

- Wall spacing of 7.6 cm is required for either washed hard crushed stone or washed coarse gravel.
- Wall spacing of 15 cm (double the thickness) is required for sand as a substitute bullet-resistant material, i.e., requires larger channels or angle wall studs.

The inner walls shall be fully sheathed with 20-mm (0.75") plywood fastened to the channels with the good side exposed to the inside of the magazine. However, the top 30 cm may be removable to permit filling between the channels with bullet-resistant material. The bottom 15 cm may also be removable to permit removal of this material. Fasteners shall be plated and countersunk. The door and ventilators shall be the only openings.

Note: Metal "I" and "U" channels or angles of 7.6 cm (3") or greater depth may not be required for small Type 4S magazines used for the storage of detonators only,[#3] i.e., no ballistic resistance required. They are recommended for larger detonator storage magazines to provide enhanced structural rigidity.

4.6 Floor

4.6.1 The floor shall be fabricated from 6-mm metal plate with continuously welded seams. Joints between the walls and floor should be welded both inside and outside.

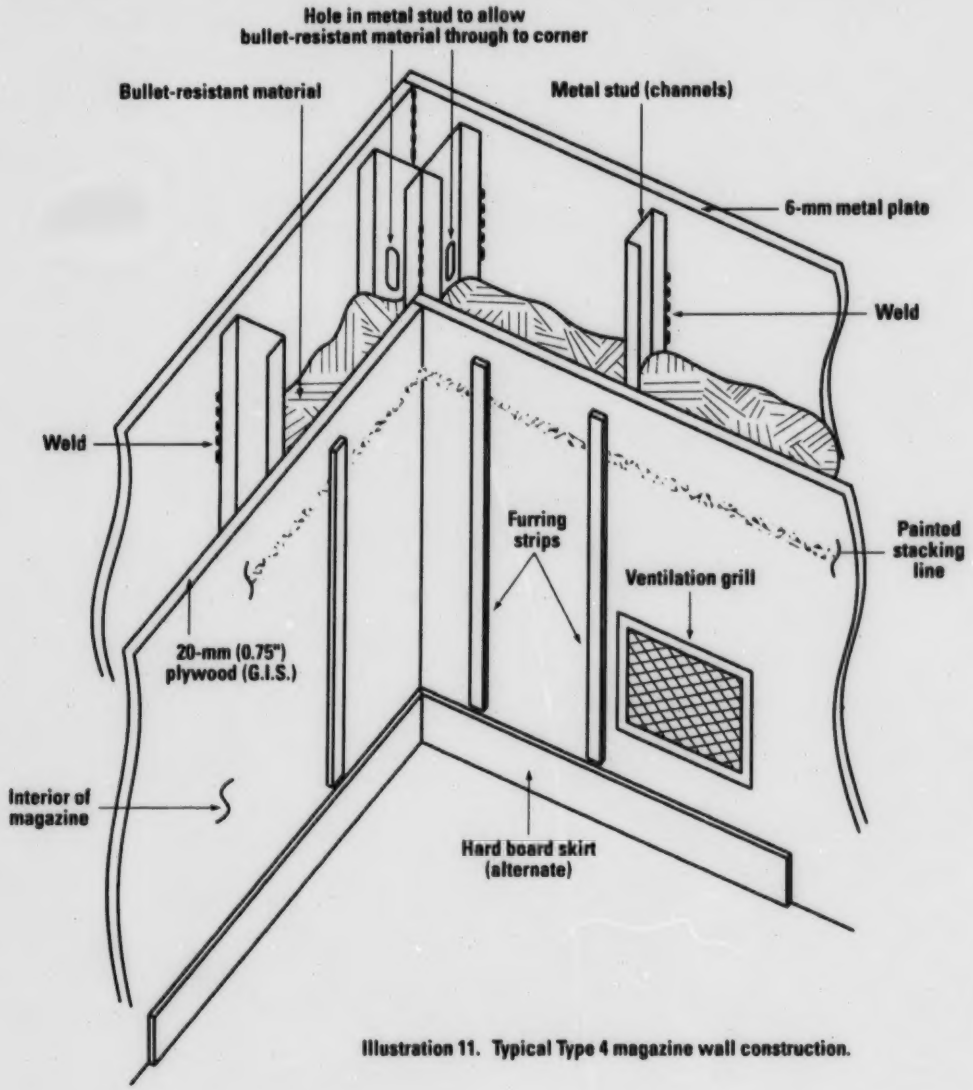


Illustration 11. Typical Type 4 magazine wall construction.

4.6.2 The floor shall be completely covered with 20-mm plywood fastened with countersunk plated or other non-sparking fasteners. An alternate durable non-sparking surface suitable for rolling materials-handling equipment may be acceptable, such as aluminum checked plate, concrete, and shiplap hardwood flooring normally used for highway trailer floors. The finished floor should be level with the top of the door stop on the sill plate.

Note: A non-sparking flooring with non-absorbing surface characteristics is recommended if storing AN/FO because of the potential for oil residue to soak into wood flooring.

4.7 Roof[#8]

4.7.1 The roof shall be fabricated from 4.7-mm or heavier metal plate with continuously welded seams. Joints between the walls and roof should be welded both inside and outside. Seams shall be watertight.

> Note: In Quebec, with the requirement for crushed gravel in the roof, it is permissible to weld on the outside only, following the installation of the crushed gravel.

4.8 Door Frame

4.8.1 The door and frame are to be considered as a total unit in an effort to minimize the distortion found from extremes in temperature cycling and settling following field installation.

The door frame will be fabricated and welded as a unit, i.e., top, bottom and two sides, from 12.7 cm x 7.6 cm x 0.6 cm steel tubing unless otherwise specified.

> Note: It is recommended that the top horizontal tubular header and footer be extended on either side of the door frame by approximately 25 cm (10") and that external corner gussets be incorporated to facilitate stiffening the frame and thus minimize distortion resulting from frost heave, magazine transport, etc. This is strongly recommended for larger magazines over 6 m (20') in length.

The vertical portion of the tubular frame, with the exception of the horizontal header and footer, is to be filled with bullet-resistant material up to the same height as the interior stacking line as described in subsection 4.11. A door stop consisting of square steel bar stock shall be welded to the top and both sides of the door frame after having temporarily installed the door to account for any warpage during fabrication (refer to Illustrations 12 and 13).

At the option of the fabricator/client, a similar square steel bar stock or an angle iron stop can be incorporated at floor level to facilitate keeping the environmental weather elements such as rainwater or melting snow from running under the door and along the finished floor.

The floor should be level with the top of the door stop on the sill plate. On the other hand, eliminating the bottom door stop will facilitate the movement of a pallet loader in and out of the magazine. Ultimately, the final choice is up to the client, taking into consideration the potential environmental problems when the bottom door stop is not installed.

> Note: Frame distortion and subsequent door warpage have been noted from extreme temperature cycling and magazine settling following field installation and thus may aid a forced pry attack. To minimize such an attack, the exterior of the frame may be built up with flat stock so as to be flush with the door and therefore compensate for the door warpage. This is to be a field retrofit only and added if directed by an explosives inspector.

A less preferred method is to field weld an angle iron on the exterior of the door frame. One leg of the angle would be perpendicular to and mounted close to the door opening. If necessary, the angle iron can be positioned on three sides of the door opening (not the hinge side). Again, this retrofit may only by added at the discretion of an explosives inspector.

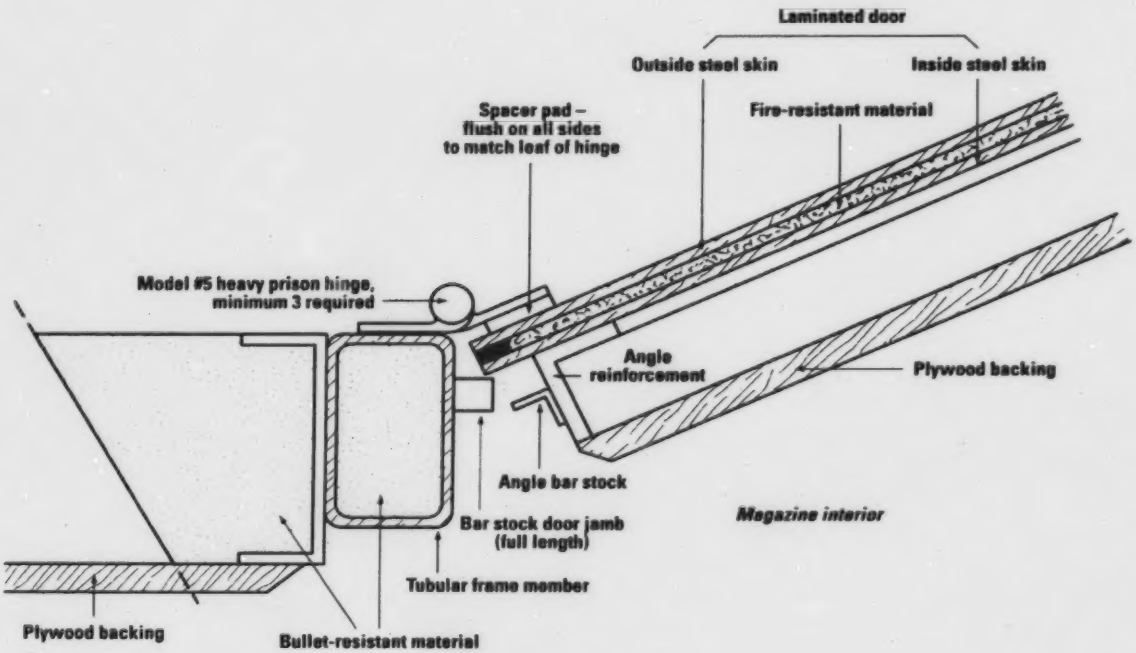


Illustration 12. Typical hinge configuration (plan view).

Note: Door partially open illustrating full-length security bar (stock) behind hinge.

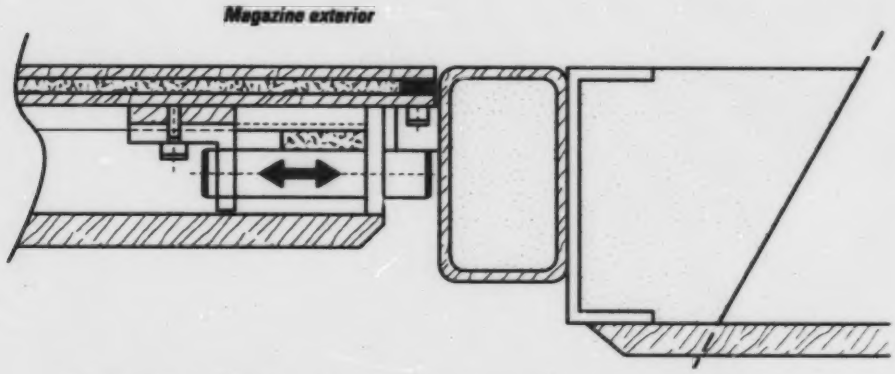


Illustration 13.1. Typical Types 1 and 4 magazine door and frame in closed position.

Note: Plan view.

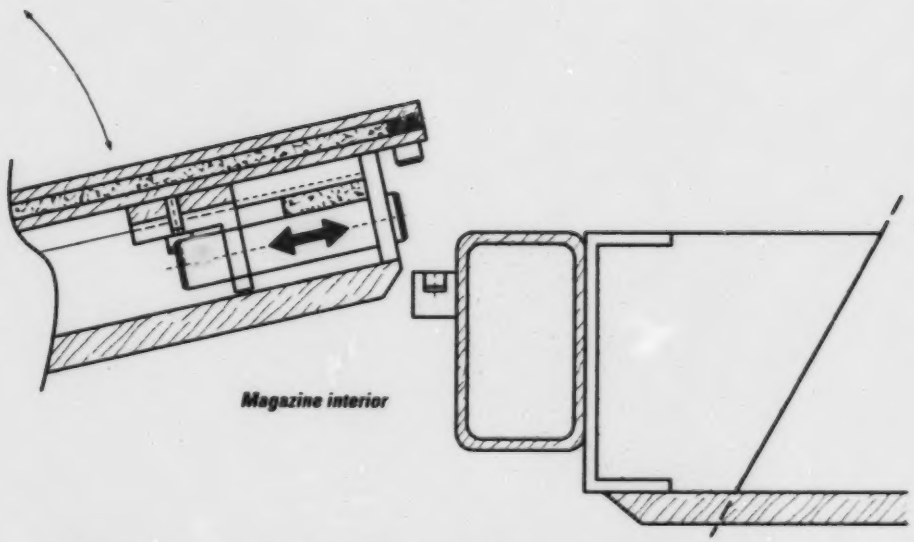


Illustration 13.2. Typical Types 1 and 4 magazine door and frame in open position.

Note: Plan view.

4.9 Door(s), Lock(s) and Hinges for Type 4 and Type 4S

4.9.1 The door(s), lock(s) and hinges for a Type 4 walk-in magazine or similarly constructed door shall conform in all respects with those of a Type 1 magazine as specified in subsection 1.10 (refer to Illustrations 6, 7, 12 and 13 and Appendix B).

Notes:

- Padlocks are NOT permitted for a door constructed to a Type 4 or 4S design.
- See subsection 4.16 for a temporary alternate locking mechanism and the design criteria permitted for transit mode only with no explosives on board.
- For wider and heavier doors, four (4) hinges are recommended (refer to subsection 1.10.12).

4.9.2 For a Type 4S magazine where the door is LESS THAN 1.22 m (4') in height, there shall be:

- a minimum of TWO heavy-duty #5 institutional prison hinges. Refer to subsection 1.10.12 and reference #11 in the endnotes.
- The door shall be fitted with a sliding lock bolt train secured at a minimum of three points along the door jamb as per subsection 1.10.2 and subsections 1.10.6 to 1.10.8 inclusive.
- The door frame shall be a minimum of 7.6 cm x 5.0 cm x 0.6 cm steel tubing.
- The door stiffening angle shall be a minimum of 6.35 cm x 6.35 cm x 0.64 cm.

Rim or mortise mounted cylinders and deadbolt-type locks coupled with the sliding bolt train system shall have a weakened weather protector hood as outlined in subsection 1.10.9 and shown in Illustration 6.

4.10 Ventilators

4.10.1 **General:** Ventilators shall be provided to ensure that the interior of the magazine is kept dry and as cool as possible. The number of ventilators required will depend on local climatic conditions (which are impossible to generalize) and the size of the magazine.

Note: A minimum ventilation area of 50 cm^2/m^3 of magazine volume is a useful guide.

When roof ventilators are not provided, then side ventilators must be installed above the stacking line and near the floor level to promote good air circulation.

For structural considerations and bullet-resistance, only straight-through and roof ventilators are approved for this type of magazine, with the exception of walls that are designed for 15 cm of sand. In this instance, offset ventilators as outlined in subsection 1.11.2 may be considered (refer to Illustration 8).

4.10.2 Straight-Through Ventilators: Such ventilators shall not exceed 15 cm x 15 cm and shall be protected by a stand-off metal plate at least 12 mm thick and twice the dimensions of the opening, positioned not more than 8 cm from the wall. It may be sloped to form a hood and be continuously welded to the walls along the top and two sides. The outside and inside openings shall be covered by flattened expanded metal welded on the outside to the walls and on the inside to a metal frame fastened to the non-exposed face of the plywood sheathing. An acceptable alternate is to weld a 4.7-mm-thick or more mild steel plate with multiple 1-cm holes, equally spaced. A flyscreen is recommended. Refer to Illustration 14, which shows a typical installation.

TYPICAL STRAIGHT-THROUGH VENTILATOR

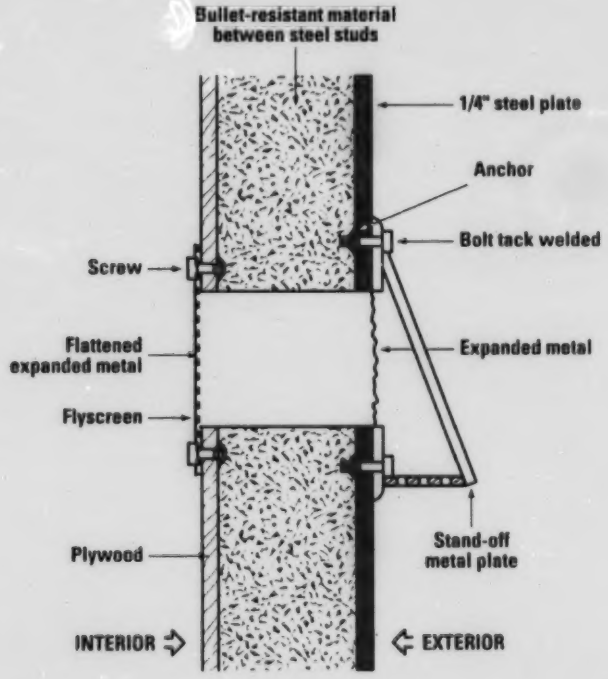


Illustration 14. Straight-through ventilator installation for Type 4 steel magazine.

4.10.3 Roof Ventilators: Various styles of roof ventilators are on the market. They may be used provided any opening in the roof does not exceed 20 cm in diameter and is protected by a minimum of two X-bars of 12 mm x 35 mm steel and 5-mm flattened expanded metal welded in place or otherwise firmly fastened across the opening. The boxes are to be constructed as per typical roof construction to avoid water filtration. In addition, a welded cage fabricated of expanded metal and 6-mm angle iron shall be firmly mounted over the ventilator and fixed to the roof (refer to Illustration 10).

4.11 Bullet-Resistant Materials [#6]

4.11.1 The minimum 7.6-cm space or void between the wall channels shall be filled with bullet-resistant materials from the floor to not less than 30 cm from the ceiling. Either washed hard crushed stone or washed coarse gravel up to 6 mm in size may be used. Material shall be dry before use.

Notes:

- A space or void between the wall channels of 15 cm is required if SAND is used as a substitute bullet-resistant material. Refer to subsection 4.10.1 for off-set ventilators when using sand. Refer to Part III, subsection 4.0.2.
- For detonator magazines,[#3] it is not necessary to fill the walls with bullet-resistant material.
- Where weight is a concern, ERD will consider equivalent ballistic-resistant rigid panel wall configurations as tested by the Canadian Explosives Research Laboratory (CERL).

4.12 Stacking Line

4.12.1 On the interior walls of the magazine shall be painted or otherwise permanently marked a red line 10 mm wide at a distance at least 15 cm below the height of the bullet-resistant material. This line indicates the maximum height to which explosives may be stacked.

Note: Should the bullet-resistant material settle or leak out over time, then the stacking line will need to be lowered accordingly (along with reduced quantities of explosives) or the bullet-resistant material will need to be topped up.

4.13 Interior Finish

4.13.1 All exposed metal surfaces on the interior, such as the ceiling, shall be painted with a rust-inhibiting paint. It is recommended that the metal of the walls and floor be so protected prior to installing the plywood lining.

4.13.2 For heating and/or insulation requirements, refer to Section G8 and Appendix C of this Part.

4.13.3 To provide air circulation and to prevent cases of explosives from being stacked directly against the walls, refer to subsections 1.13.1 and 1.13.2.

4.14 Exterior Finish

4.14.1 To prolong the life of Type 4 and Type 4S magazines, it is recommended that the exterior be painted with rust-inhibiting paint in a heat-reflecting colour such as aluminum.

4.14.2 An eavestrough shall be installed immediately over the entry door and extend well beyond each side of the door (15 cm [6"] is recommended). It must be fully welded (not tacked) to the lintel along its full length to prevent or minimize any rainwater run-off or melting snow from eventually working its way into the door-locking mechanism or door jamb.

Notes:

- This is particularly critical during the freeze/thaw cycles experienced in most parts of the country.
- If not installed, there is a high potential to temporarily jam the lock mechanism.

4.15 Joining Magazines Together

4.15.1 If required, magazines may be joined utilizing various techniques to tie them together. From an engineering standpoint, such magazines will need to incorporate additional internal structural integrity for the anticipated roof load and additional support during the transit mode as dictated by the *National Building Code of Canada* and CAN/CSA-S16.1-94 *Limit States Design of Steel Structures*.

The joining of steel magazines tends to be a weak link from a security perspective and thus, when designed, needs to take the following into consideration:

- ballistic resistance,
- punch attack,
- pry attack,
- drill attack, and
- be camouflaged on the exterior as much as is practical.

The preference is to weld the entire units together at their final destination. The joint design must be submitted to ERD for approval. Failure to do so may result in the magazine being UNACCEPTABLE for licensing and use.

4.16 Transport Mode Locking

4.16.1 Many Type 4 magazines are designed to be portable and, as such, when relocated are exposed to abnormal stresses that can damage the undercarriage, door hinges and lock mechanism. Users are frequently tempted to move the magazines with the lock normally provided with the magazine in its locked position. This can lead to distortion and additional problems in accessing the magazine at a later date and it is therefore highly recommended that an optional means of securing the door be provided for the transit mode with no explosives on board. Refer to subsection 1.10.11 for additional information regarding a door clamp/wedge.

Note: The criteria to be used in the design of an alternate locking mechanism for transit purposes (when empty) are to have no protrusions on the door itself that allow for a pulling attack or a pry point. The securing mechanism may be suitably locked with a standard padlock during this transfer stage only.

SECTION 5 - TYPE 5 MAGAZINE

(Converted Transport Trailer, Truck Box or Rail Car)

5.1 Type 5 magazines built to the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators* will no longer be permitted as an option for new magazines commencing May 31, 2001. Refer to Type 4 and Type 11 magazines for a suitable replacement and to Part III for the phase-out period of existing magazines.

Note: Type 11 magazines have limited applications as the exterior wall construction is NOT equivalent to Type 4 magazines, i.e., the thinner exterior wall has lower ballistic resistance and is more susceptible to a forced attack.

SECTION 6 - TYPE 6 MAGAZINE

(Bin, Box or Cupboard)

6.1 Uses[#9]

6.1.1 These magazines are not walk-in-type storage facilities. Magazines built to this standard may be used as licensed or unlicensed magazines, e.g., as a day box for the storage of small quantities of industrial explosives (refer to subsection G.1.1), including detonators, and must conform to all applicable laws. For additional security the magazine may be placed in a suitable building or fenced area that is also securely locked and totally controlled by the licensee (refer to subsection 6.9). In specific situations where a Type 6 magazine is used in the open environment and is exposed to the elements, it must be either firmly anchored internally or weigh a minimum of 200 kg when empty (refer to subsection 6.9).

Note: Specific situations must be discussed with a regional inspector. Otherwise, the magazine may not be licensed for the intended application.

6.1.2 The maximum storage quantity for a Type 6 magazine is 10 cases of blasting explosives (250 kg) or 10 cases of detonators as packaged by the manufacturer and approved by the competent authority. Reduced quantities may apply to particular segments of the explosives industry under certain conditions (refer to subsection 6.4.1). If unsure, contact ERD for clarification.

6.1.3 When not in use as a licensed magazine, the magazine may be used as a transportation container or as a day box under the following conditions:

- The use of day boxes for industrial explosives falls under provincial jurisdiction.
- A day box may be used on a work site where there is a requirement to safeguard explosives at the place of use. A day box denotes an unlicensed facility that is not used for overnight storage.
- A transportation container may be carried in a truck cargo box during which time it shall be locked and otherwise conform to all applicable regulations (refer to subsection 6.9.2).

6.2 Basic Construction

6.2.1 A Type 6 magazine shall be a metal receptacle with a closely fitting lid/door secured by one or two high-security padlocks or speciality lock system according to Appendix B. The shape of the magazine may be in the form of a bin, box or cupboard with a lid or a door.

6.3 Materials

6.3.1 Plywood shall be exterior fir ply type. Faces exposed on the magazine interior shall be good one side (GIS).

6.3.2 Expanded metal shall be 5-mm Short Way Dimension (SWD) openings, 20-gauge (3/16"-20) flattened for ventilation openings.

6.3.3 Metal plates and shapes shall be mild steel unless otherwise stated. Refer to subsection 6.7 for an exception concerning hasps and staples with respect to the requirement for Type 316 stainless steel.

6.4 Size and Storage Capacity

6.4.1 The internal volume shall not exceed 0.6 m^3. This volume is generally sufficient for the storage of 10 cases (maximum of 250 kg - refer to subsection 6.1.2) of most industrial explosives, allowing sufficient empty space for handling and air circulation. For lesser quantities the volume (size) may be reduced accordingly.

6.5 Structural Design

6.5.1 Only metal structural designs may be used in the construction of a suitable magazine because of its inherent strength and minimal maintenance requirements.

The detailed design, within these guidelines, is left to the ingenuity of the builder, depending on the end purpose, provided that the magazine is reasonably secure against break and entry and, if used in an exposed location, is capable of being anchored internally or weighs a minimum of 200 kg when empty and is weatherproof.

6.5.2 Metal: The magazine shall be fabricated from 6-mm metal plate with welded seams. All welds shall be continuous and sound. Lids and doors shall be close fitting. Lids should have an external lip at least 25 mm deep around the perimeter and shall have a gasket weather seal or other means of preventing the ingress of driven snow or rain.

The interior shall be lined with 12-mm plywood (minimum thickness) so that there is no exposed metal in the interior. Special circumstances, such as police usage, may preclude that the interior of the magazine be lined with ballistic-resistant rigid panels. Consult with the appropriate regional explosives inspector for advice. Refer to Illustrations 15 and 16 and subsection 9.2.1.1 of this Part for information regarding alternate bullet-resistant rigid panels.

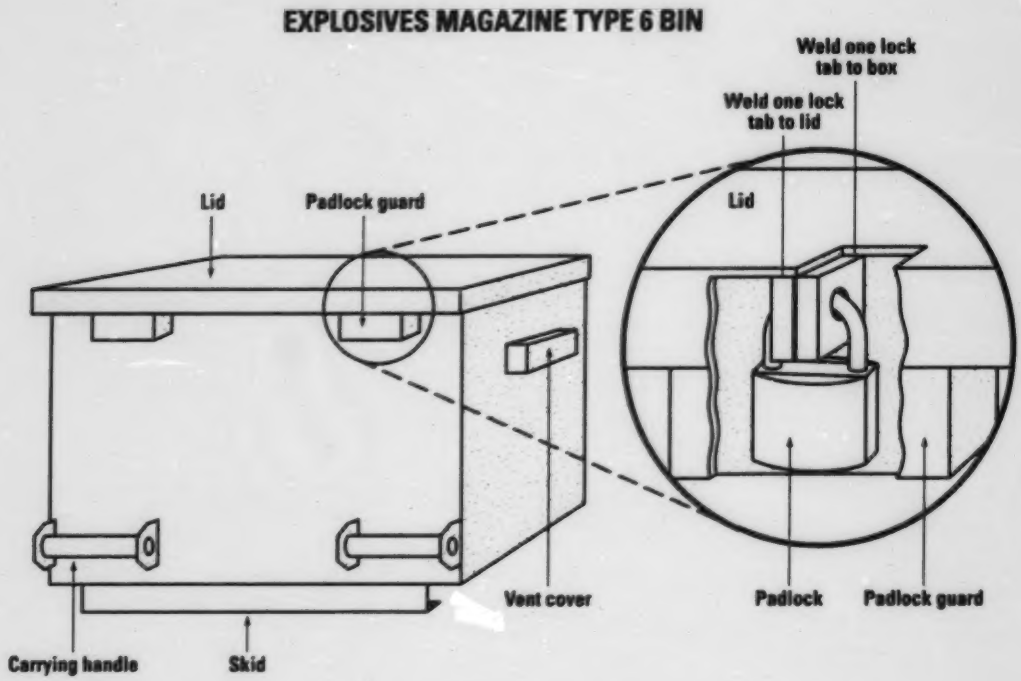


Illustration 15. Typical bin design of a Type 6 magazine.

Note: Type 316 stainless steel staple/hasp required.

EXPLOSIVES MAGAZINE TYPE 6 CUPBOARD

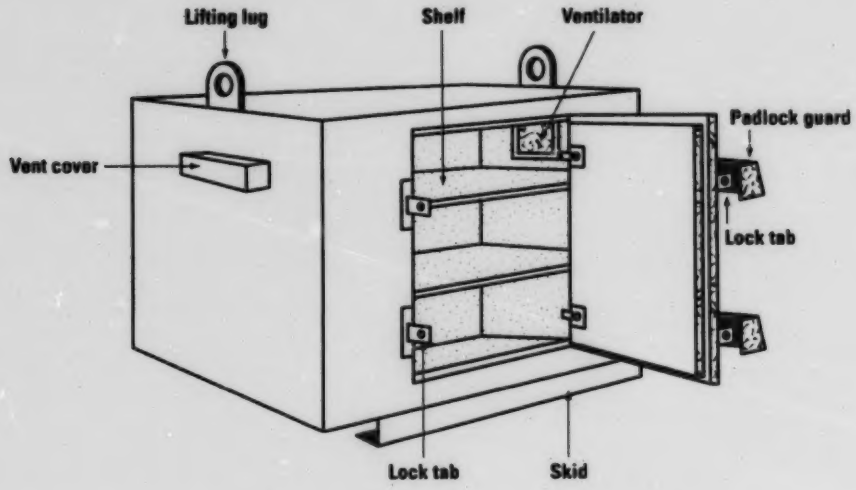


Illustration 16. Typical cupboard design of a Type 6 magazine.

6.6 Ventilation

6.6.1 For larger designs the magazine shall be raised at least 10 cm to facilitate lifting and to improve air circulation underneath. Additional ventilation, if required, shall be provided by drilling or cutting not more than three holes or slots, each 6.5 cm^2 or less, in the upper half of the sides. A screen of flattened expanded metal with 5-mm Short Way Dimension (SWD) openings, 20-gauge (3/16"-20), shall be securely welded over the ventilator openings. A flyscreen may also be added, if required. If exposed to the weather, ventilators shall be provided with an external hood.

6.7 Hinges, Hasps, Security Lugs and Padlock Guards

6.7.1 For security against a forced entry, the hinge side of the lid shall be designed to prevent the lid from being opened from that side if the hinges are cut or if the hinge pins are removed. This may be achieved by installing a security flange or security lugs on the inside of the lid that will recess into or nest behind a section of the box to which the lid is hinged.

Hinges shall be of a medium-duty type or better as per subsection 1.10.12, welded in position with non-removable (fixed) pins to prevent their removal by a forced attack (refer to Illustration 17). Series 8378/200 by Faucher Industries INC.[#11] or Marr Weld-on Hinges, series FSP-200 or equivalent, are highly recommended for such a purpose.

Notes:

- The materials for the hasps and staple/locking tabs must be Type 316 stainless steel (6.35 mm [0.25"] minimum thickness) and designed similar to those in Illustrations 15 and 16.
- Ensure that the appropriate weld rod is used to join stainless steel to mild steel.

The holes in the stainless steel staple and hasp must conform to the shackle diameter of the padlock, when installed, to give it a snug fit.

The protective padlock guards (hoods) shall be fabricated from 6.35-mm (0.25") metal plate, be welded all around, and be of sufficient depth to protect the body of the padlock from a pry force or cutting attack.

Hasps shall be located at a distance from each corner equivalent to one quarter of the width of the opening. When the opening is 60 cm or less, a single hasp or locking tab and padlock may be installed at the centre.

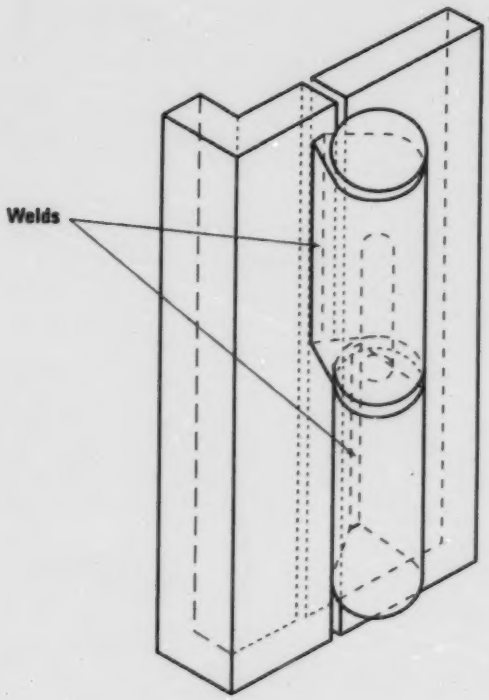


Illustration 17. Typical medium-duty hinge with non-removable fixed pin, suitable for types 6 and 10 magazines.

6.8 Padlocks

6.8.1 Approved high-security padlocks and cylinders or speciality locks as listed in Appendix B shall be used.

6.9 Security

6.9.1 The user/owner of the explosives is responsible for their security. To deter the theft of a Type 6 magazine and its contents the magazine shall:

6.9.1.1 When licensed and used in a stand-alone permanent situation, i.e., fixed and at times unattended overnight:

- Must have a permanent tie-down mechanism accessible from inside the magazine (refer to Note 2 below for an exception).

NOTE 1: As an example, provide as a minimum two 1-cm bolts, accessible from the inside of the magazine only, to enable the magazine to be firmly anchored to an external solid object such as a rock or a concrete slab weighing a minimum of 200 kg. Any exposed metal inside the magazine must be covered.

NOTE 2: When the magazine is located inside a secured building, controlled fenced area, or permanently attached to production equipment (refer to subsection 6.9.1.3), the requirement for a permanent tie-down may be waived by an explosives inspector.

6.9.1.2 When licensed and used alone in a "temporary" situation, e.g., zone licence, and at times unattended overnight:

- Must weigh at least 200 kg when empty.

Note: Removable weights or concrete in the bottom may be added, if necessary, to achieve this overall weight. Such internal weights shall be separated from the explosives by a wood partition. The weights shall be affixed so that the added weight cannot be removed when the magazine is locked.

OR

- Must have a permanent tie-down mechanism accessible from inside the magazine that allows the magazine to be tied to a temporary external anchor such as an expanding ground screw, firmly embedded post, or temporary concrete pad weighing a minimum of 200 kg.

Note: Being secured by means of a hardened steel chain or substantial wire cable with a padlock is not permitted.

6.9.1.3 When licensed and substantially fixed internally to a vehicle and at times unattended overnight, the magazine may:

- When deemed, by an explosives inspector, to be a transportation unit traveling at any time on public roads, shall require an anti-theft system and/or additional locks that immobilize the vehicle/magazine from unauthorized tampering under the conditions stipulated in the *Explosives Act and Regulations*, Section 63(s.1).

- When deemed, by an explosives inspector to be a production unit, e.g., track drill rig, used in remote locations only, shall not require an anti-theft system or other alarm/additional locking mechanisms.

6.9.2 When used as a transportation container, e.g., as a day box, in the open cargo space of a vehicle, provision shall be made to secure the magazine(s) in the vehicle by holdfasts or other suitable means.

If transporting both industrial explosives and detonators in the same vehicle, provision must be made to maintain separation between the two to prevent communication of an explosion or fire (refer to Bulletin #17 titled *Explosives Transportation - Partition Between Blasting Caps and Blasting Explosives* and Section 62(a)(iii) of the *Explosives Regulations).*

6.10 Exterior Finish and Signs

6.10.1 To comply with the many municipal by-laws and with provincial and federal regulations, it is recommended that:

- the exterior of the Type 6 magazine(s) be finished in red or a heat-reflecting colour, e.g., aluminum; and

- the magazine area be posted with warning signs generally with reference to "No Trespassing" and penalty as noted in Section 18 of the Canadian *Explosives Act*. If warranted, the wording should be in the prevalent language of the community, e.g., French, Aboriginal, Inuit, etc. Ideally, the signs should not be posted in a manner that would attract undue attention or in the line of sight of the magazine. Normally, signs should not be placed on the magazine itself.

Depending on local conditions, the wording of the sign(s) and exceptions may vary at the discretion of an explosives inspector together with those required by municipal by-laws and/or provincial regulations.

6.10.2 Each magazine licensed by ERD is to be issued a unique number/letter combination (code). Refer to Section G.11 for details.

SECTION 7 - TYPE 7 MAGAZINE

(Metal Plate, Two Compartments)

7.1 Type 7 magazines built to the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators* will no longer be permitted as an option commencing on May 31, 2001. Refer to Type 4, Type 4S and Type 9 magazines for a suitable replacement and to Part III for the phase-out period.

SECTION 8 - TYPE 8 MAGAZINE

(Reinforced Concrete)

8.1 Uses

8.1.1 Magazines built to this standard are suitable for use as permanently located or portable magazines for the storage of industrial explosives as defined in subsection G.1.1.

8.1.2 However, because the formation of missiles in the event of an accidental explosion of the contents is an unknown factor that is not readily determinable, their use at explosives factories or in complexes containing numerous magazines shall require special consideration of siting in relation to the Canadian *Quantity Distance (Q/D) Principles*. Also note that, in populated areas, even though the prescribed minimum quantity/distances have been met, it may be necessary to either increase these distances or to sandbag or otherwise barricade the walls of a Type 8 magazine to decrease the missile hazard in the event of an accidental explosion. For fixed locations, Type 1 magazines may be preferred.

Consult ERD to make your intentions known prior to proceeding; otherwise, the installation may not be approved.

8.2 Basic Construction

8.2.1 The structure shall be of reinforced concrete sufficiently thick and of such inherent strength to provide resistance to bullets and forcible entry, and have the characteristics of a Faraday cage (a metal wire configuration for lightning protection).

8.3 Materials

8.3.1 Concrete shall have a minimum compressive strength of 350 kg/cm^2 (5000 psi) after curing and have a minimum thickness of 15.25 cm (6.0").

8.3.2 Metal reinforcement bars for concrete shall be cold-rolled steel with a minimum diameter of 10 mm.

Note: No wire mesh is permitted.

External edges and corners may be protected with angle iron.

8.3.3 Plywood shall be exterior fir ply type. Faces exposed on the interior shall be good one side (GIS).

8.3.4 Metal plates and shapes shall be mild steel unless otherwise stated.

8.3.5 For ventilator openings, metal screening shall be 5-mm Short Way Dimension (SWD) opening, 20-gauge (3/16"-20) flattened expanded metal.

8.4 Foundation

8.4.1 The structure shall be mounted on a well-drained concrete slab foundation (refer to subsection 1.4) or on metal I-beams giving a minimum ground clearance of 10 cm.

8.5 Floor

8.5.1 The floor shall be a continuous reinforced concrete slab at least 15.25 cm thick. Metal reinforcement bars shall be firmly anchored in the floor slab and spaced in both directions to form a grid 30 cm square. The rebar must be wired together at the cross points to form a Faraday cage (for lightning protection). If the floor, walls and roof are poured separately and/or in modules to be joined together later, then provision must be made to bond the rebar at the joints so as to form a continuous Faraday cage when the modules are assembled. A minimum of two ground terminals located at opposite corners of the floor exterior must be provided to allow the connection of ground rods where required by jurisdictions having authority.

8.6 Walls and Roof

8.6.1 The walls and roof shall be formed with reinforced concrete at least 15.25 cm thick. Metal reinforcement bars shall be spaced both horizontally and vertically to form a grid 30 cm square throughout and be wired together at the cross points so that it will form a Faraday cage (for lightning purposes) when bonded later. When formed separately, the components must be keyed and sealed with a fire-resistant (4-hour rating) mastic. The individual components will need to be electrically bonded to complete the Faraday cage envelope, which includes the door frame.

8.6.2 To prevent spalling from a bullet impact, the interior walls shall be covered with 20-mm plywood from floor to ceiling.

8.6.3 To control moisture, it is recommended that the outer walls be sealed with a vapour-barrier-type concrete paint or sealer. Combustible extruded foam insulation (e.g., polystyrene) is not permitted.

8.7 Door Frame

8.7.1 The door frame shall be fabricated from either two 6 mm x 50 mm x 50 mm (minimum) angle irons continuously welded to form a channel or a 100 mm x 50 mm x 6 mm (minimum) channel. It shall be cast in the concrete and anchored into the walls via welding to

the reinforcing bars and continuously welded at the corners. A door stop of 25-mm^2 steel bar stock shall be welded to the top and both sides of the door frame after the door has been temporarily installed to account for any warpage in fabrication. A similar 25-mm^2 steel bar stock or a 6 x 25 x 25 mm angle iron can be used for the door stop at floor level, all welded in place and incorporated with the sill channel plate. In each case, the floor slab could be topped up and finished level with the door stop.

8.8 Door(s), Lock(s) and Hinges

8.8.1 The door(s), lock(s) and hinges for a Type 8 magazine shall conform in all respects with those of a Type 1 magazine as specified in subsection 1.10.

8.9 Ventilators

8.9.1 General: Ventilators shall be provided to ensure that the interior of the magazine is kept dry and as cool as possible. The number of ventilators required will depend on local climatic conditions at the place of use (which are impossible to generalize) and on the size of the magazine. For structural considerations and bullet-resistance, only straight-through and roof ventilators are approved for a Type 8 magazine. A minimum ventilation area of 50 cm^2/m^3 of magazine volume is a useful guide.

8.9.2 Straight-Through Ventilators: Such ventilators shall not exceed 15 cm x 15 cm and shall be protected by a stand-off metal plate at least 12 mm thick and twice the dimension of the opening, positioned not more than 8 cm from the wall. It may be sloped to form a hood and, if in contact with the wall at the top and sides, its size may be decreased accordingly. For the latter, it is advisable to incorporate an angle iron frame imbedded in the concrete so as to weld the hood to it. For additional security, the centre of the opening shall coincide with the intersection of a horizontal and a vertical metal reinforcing bar. The outside and the inside of the opening shall be covered by expanded metal, preferably imbedded in the concrete of the wall (refer to subsection 1.3.7). Ventilation at the floor level and above the stacking line is recommended, as well as a flyscreen (refer to Illustration 14 for a typical installation).

8.9.3 Roof Ventilators: Various styles of roof ventilators are on the market. They may be used provided any opening in the roof does not exceed 20 cm in diameter and is protected by a minimum of two X-bars of 12 x 35 mm steel welded or otherwise firmly fastened across the opening. In addition, a welded cage fabricated of expanded metal and 6-mm angle iron shall be firmly mounted over the ventilator and fixed to the roof (refer to Illustration 10 for a typical installation).

8.10 Interior Finish

8.10.1 To provide air circulation and to prevent cases of explosives from being stacked directly against the plywood lining of the walls, 25 mm x 50 mm furring strips shall be fastened to the usable portions of the walls, vertically on 30-cm centres starting 15 cm from the floor level and must be continuous to the stacking line. As an alternative, it is permissible to install a 5 cm x 15 cm hardwood skirt at floor level, around the perimeter of the magazine, for the stand-off of palletized product. For detonator magazines, wooden shelves for part cases or inner packages are preferred. Any exposed ferrous metal, particularly around the doors, that could accidentally be

struck during the handling of explosive material shall be covered by wood or otherwise protected. Similarly, all concrete remaining exposed on the interior, including the ceiling and floor, shall be sealed with concrete paint or sealer.

8.10.2 The use of duckboards or pallets will improve air circulation and control moisture, cleanliness and ease of decontamination (refer to subsection 8.9 above on ventilation).

8.10.3 When registered as a licensed magazine, the magazine will be given a unique numbered/lettered tag that will stay with it throughout its useful life span. This unique code must be noted on the magazine licence (refer to Section G.11).

8.11 Stacking Line

8.11.1 On the interior walls of the magazine shall be painted, or otherwise permanently marked, a red line 10 mm wide at a distance at least 15 cm below the ceiling. This line indicates the maximum height to which explosives may be stacked.

SECTION 9 - TYPE 9 MAGAZINE

(Seismic Prospecting and Remote Area Contractors)

9.1 Uses

9.1.1 Magazines used by seismic exploration crews and general contractors in remote areas for highly mobile storage facilities shall be constructed to conform in many respects to a Type 4 magazine. In some cases, there are exceptions for a modified Type 4 locking system and hinge configuration depending on the door size, in which case it may be known as a Type 4S, or when combined or multi-compartmented, it will be known as a Type 9 magazine as noted below.

These magazines, in all cases, will be transported empty to the job site. Once at the job site they may be either:

- off loaded and used, on skids, as a conventional stand-alone explosives storage magazine,
- remain on the wheeled chassis (trailer), or
- be an integral part of a trailer.

When in transit and mounted on a wheeled chassis, the magazine must be equipped with approved electric brakes and running lights. The magazine must be adequately and firmly anchored to the trailer chassis.

When at the job site, the hitch of each magazine trailer must be equipped with a hitch cover locked in place by an approved high-security padlock for added security (refer to Appendix B).

9.2 Construction

9.2.1 Stand-Alone Magazine:

9.2.1.1 When in a stand-alone configuration, whether on a wheeled chassis or not, and the entrance door is GREATER than 1.22 m (4') in height, the magazine shall conform in all respects to a Type 4 magazine with exceptions to subsections 4.2 and 4.11 where equivalent bullet-resistant materials will be permitted for weight considerations. The alternate bullet-resistant material shall be either:

- Armortex™ #11 bullet-resistant fibreglass rigid panels,
- ArmorLyte™ #11 rigid aramind fibre in matrix (KEVLAR),

or other equivalent material, as tested by CERL, in conjunction with the 6-mm mild steel plate.

Note: Contact ERD for the appropriate thickness of the equivalent bullet-resistant material and the configuration of the wall cross-section.

9.2.1.2 When in a stand-alone configuration, i.e., whether on a wheeled chassis or not, and the entrance door is LESS THAN 1.22 m (4') in height, the magazine shall conform to a Type 4 magazine in all respects with exceptions noted in subsection 4.9.2 (hinges, door frame and angle stiffening) and in subsection 4.11 where equivalent bullet-resistant materials will be permitted for weight considerations.

A stand-alone magazine constructed with equivalent bullet-resistant material shall be licensed as either a Type 4 or Type 4S magazine. When two separate magazines are mounted on a trailer or skid, a separation of 5 cm shall be maintained between the two magazines. Note the additional designation "D" if designed for detonator use only, i.e., no bullet-resistant material in walls (refer to Section G.11 and subsection 4.1.1).

9.2.2 Multi-Compartment (Type 9):

When a larger Type 4 magazines is coupled with a smaller Type 4S magazine or when two Type 4 magazines or two Type 4S magazines are combined as one with a 5-cm separation between them, they shall be KNOWN AS A TYPE 9 (MULTI-COMPARTMENT) MAGAZINE. The 5-cm air gap may be enclosed with mild steel plate on each side such that the two separate magazines appear as one when viewed externally from the side. There shall be two doors, one for each magazine, located at opposite ends of a multi-compartment magazine(s), i.e., one large door allowing access to two separated magazines is not permitted. When combined as a multi-compartment configuration and permanently fixed on a trailer or skid, it is permitted to have both magazine doors keyed alike.

Notes:

- One common single wall consisting of a single 6-mm mild steel plate between the two magazines is NOT permitted.
- Refer to subsection 4.16 for a temporary alternate locking mechanism and design criteria permitted for transit mode only with no explosives on board.
- NO padlocks are permitted.

Rim or mortise mounted cylinders incorporated in deadbolt-type locks plus sliding lock bolt train systems shall have a weakened weather protector hood as outlined in subsection 1.10.9 and shown in Illustration 6.

Refer to Appendix B of Part I for a list of approved locks.

9.3 Exterior Finish

9.3.1 To prolong the life of a Type 4, Type 4S or Type 9 magazine, it is recommended that the exterior be painted with rust-inhibiting paint in a heat-reflecting colour such as aluminum.

9.3.2 An eavestrough shall be installed immediately over the entry door and extended well beyond each side of the door; 15 cm (6") is recommended (refer to subsection 4.14.2).

9.3.3 A small magnetic shield, i.e., refrigerator-type magnet, is recommended to cover the door keyhole while in the transit mode.

SECTION 10 - TYPE 10 MAGAZINE

(Aluminum)

10.1 Uses

10.1.1 Magazines built to this standard are authorized for special applications, such as pipeline joining (welding), prospecting, or heliportable magazines for seismic operations in isolated locations, and are suitable for short-term storage of either blasting explosives and detonating cords, or detonators.

10.1.2 The maximum quantities that may be stored shall not exceed 25 kg (one case) of blasting explosives and 600 m of detonating cord (two spools), or one case of detonators as packaged by the manufacturer and approved by the competent authority or 1000 detonators, whichever is less.

For short-term overnight storage or attended day-time storage, exceptions to quantity limitations and accompanying magazine size may vary according to accepted industry practice when approved in a magazine licence issued by an explosives inspector for special operating circumstances.

10.1.3 When not in use as a magazine, it may be used as a transportation container or as a day box under the following conditions:

- The use of day boxes for industrial explosives falls under provincial jurisdiction.
- A transportation container may be carried in a truck cargo box, for example, during which time it shall be locked and otherwise conform to all applicable regulations (refer to subsection 10.9.2).
- A day box may be used on a work site where there is a requirement to safeguard explosives at the place of use. A day box denotes an unlicensed facility that is not used for overnight storage (refer to subsection 10.9.1).

10.1.4 **Air Transport:** Due to their low weight, Type 10 magazines are suitable and highly recommended for safeguarding explosives during transport by light aircraft and helicopter. When closed, they are impervious to electromagnetic radiation.

10.2 Basic Construction

10.2.1 A Type 10 magazine shall be an aluminum receptacle with a closely fitting lid or door secured by a padlock(s). The shape may be in the form of a bin, box or cupboard.

10.3 Materials

10.3.1 Metal plate shall be aluminum alloy 5083-H32 or better. Welding filler rod 5356 is recommended for the 5083 alloy.

10.3.2 Plywood shall be exterior fir ply grade. Faces exposed to the interior shall be good one side (G1S).

10.4 Size and Storage Capacity

10.4.1 The internal volume of the magazine shall not exceed 0.06 m^3. This volume is sufficient to hold one case of most blasting explosives, detonating cords, detonators, or pipe-joining charges. Exceptions may be granted for special operating circumstances such as attended daytime usage (refer to subsection 10.1.2).

10.5 Structural Design

10.5.1 The detailed design of the magazine within the guideline of this standard is left to the ingenuity of the builder depending on the end purpose, provided that the magazine is reasonably secure taking into consideration the isolation factor and, if it is to be used in an exposed location, that it is weatherproof. A typical design is the Type 6 magazine.

10.5.2 The magazine shall be fabricated from 6-mm aluminum plate with welded seams. All welds shall be continuous and sound. Lids or doors shall be close fitting. Lids should have an external lip at least 25 mm wide around the perimeter. Doors should preferably be slightly inset to provide a similar lip. They shall be fitted with a gasket weather seal or other means of

preventing the ingress of driven snow or rain. The magazine is to be lined with 6 mm of plywood.

10.6 Ventilation

10.6.1 Because of the magazine's special application, which generally requires fast stock turnover or short-term storage, the installation of a ventilation system is not mandatory. If ventilators should become necessary, they shall be installed in accordance with subsection 6.6.

10.7 Hinges, Hasps, Security Lugs and Padlock Guards

10.7.1 For security against a forced entry, the requirements of subsection 6.7.1 shall be followed, except for the requirement of Type 316 stainless steel hasps and staple. In most designs only one hasp should be required, but this depends on the size.

10.8 Padlocks

10.8.1 Approved high-security padlocks or speciality locks as listed in Appendix B shall be used (refer to subsection 6.7.1 for required number of lock(s) criteria).

10.9 Security

10.9.1 To deter the theft of a Type 10 magazine and its contents, the magazine shall:

10.9.1.1 When licensed and used in a stand-alone permanent situation, i.e., fixed and at times unattended overnight:

- Meet the requirements of subsection 6.9.1.1.

10.9.1.2 When licensed and used alone in a "temporary" situation, e.g., with a zone licence and at times unattended overnight:

- Meet the requirements of subsection 6.9.1.2 except when the magazine is required to be airlifted for use in a remote location as intended. The requirement for additional weights up to 200 kg minimum or a tie-down mechanism may be waived by an explosives inspector for this situation only and must be noted on the licence.

Note: Type 10 magazines, when airlifted to remote regions, must be secured by means of a hardened steel chain or substantial wire cable with a high-security padlock (refer to Appendix B).

10.9.1.3 When licensed and substantially fixed internally to a vehicle and at times unattended overnight may:

- When deemed by an explosives inspector to be a transportation unit travelling at any time on public roads, shall require an anti-theft system and/or additional locks

that immobilize the vehicle/magazine from unauthorized tampering under the conditions stipulated in the *Explosives Act and Regulations*, Section 63(s.1).

- When deemed by an explosives inspector to be a production unit, e.g., heli-portable drill rig, used in remote locations only, shall not require an anti-theft system or other alarm/additional locking mechanisms.

10.9.2 When used as a transportation container in the open cargo space of a truck or aircraft, provision shall be made to secure the magazine(s) by holdfasts or other suitable means.

If transporting both blasting explosives and detonators in the same vehicle, provision must be made to maintain separation between the two to prevent the communication of an explosion or fire.

10.10 Exterior Finish and Signs

10.10.1 No exterior finish, except the protective coating on ferrous metal hinges, etc., is mandatory.

When located inside a perforating shop, for example:

- the word "Explosives" shall appear on all four sides and top and, if warranted, in the prevalent language of the community, e.g., French, Aboriginal, Inuit, etc.

When located outdoors:

- the magazine area shall be posted with warning signs generally with reference to "No Trespassing" and penalty as noted in Section 18 of the Canadian *Explosives Act*. If warranted, the wording should be in the prevalent language of the community, e.g., French, Aboriginal, Inuit, etc. Ideally, the signs should not be posted in a manner that would attract undue attention and not be in the line of sight of the magazine. Normally, signs should not be placed on the magazine itself.

The wording of the sign(s) and exceptions may vary at the discretion of an explosives inspector, depending on local conditions.

In both cases, additional signage may be required by municipal by-laws and/or provincial regulations.

SECTION 11 - TYPE 11 MAGAZINE

11.1 Uses

11.1.1 Magazines built to these standards will utilize and modify a metal-only transportation container commonly known as an ISO container or "seacan." It will be known as a Type 11 magazine and will, by the nature of its construction, have limited use.

Notes:

- Having NO bullet-resistant material in the walls IS NOT AN OPTION for a Type 11 magazine.
- The exterior wall of these magazines is NOT equivalent to that of a Type 4 magazine and thus will NOT be considered as an equivalent replacement for such under any circumstance. The thinner exterior wall has less ballistic resistance and is more susceptible to a forced attack (refer to subsections G.2.1 and 4.2.1).
- Magazines built to this standard will have LIMITED USE. Users contemplating magazines built to this standard are advised to contact an explosives inspector at the regional level prior to purchasing and modifying a used or new transportation container. Failure to do so may result in the magazine being UNACCEPTABLE for licensing for its intended use.
- Magazines built to the Type 11 standards or Type 4 (bullet-resistant version) are required for UN 1.1D products when stored near isolated and remote communities. They must be sited at least 1.6 km from population centres such as inhabited camps, villages and settlements. Such approvals and restrictions will be shown on the magazine licence.

In general, approval may be granted for use near isolated communities in Newfoundland and Labrador, Quebec's North Shore and Nouveau Quebec, and in northern regions of other provinces including British Columbia's northwest coast and northern outer islands, as well as the Yukon, the Northwest Territories and Nunavut. In such instances, the maximum storage quantity may be limited by an explosives inspector.

An explosives inspector may approve their use in other parts of Canada[#3] on an individual case basis to meet particular circumstances, e.g., mobile storage facilities (on flat-deck trailers) for construction projects.

A Type 4 or Type 4S magazine is recommended as the preferred alternative in most situations.

11.2 General Requirements

11.2.1 A modified transport container, commonly known as an ISO container or "seacan," or equivalent, is ideal for this purpose.

Note: A fully enclosed STEEL transport container in sound structural condition may be used. No fibreglass/wood composite structures are permitted.

The inside shall be modified by adding expanded reinforcing metal, metal studs, bullet-resistant material and a plywood inner lining, and a secure door, frame, hinges and lock must be incorporated as outlined in subsections 4.8 to 4.10.

11.2.2 When used as a portable magazine, it must be adequately anchored to a flat-deck trailer and, as a minimum, have a fifth wheel lock installed plus, at the discretion of an explosives inspector, have the tires removed. [#3]

11.3 Materials

11.3.1 Plywood shall be exterior fir ply type. Faces exposed on the interior shall be good one side (GIS). Particle/chipboard, as it is commonly known by, is not acceptable as being equivalent to plywood.

11.3.2 Metal plates and shapes shall be mild steel unless otherwise specified.

11.3.3 Metal reinforcing for interior walls shall be 8-mm Short Way Dimension (SWD) opening, 18-gauge (5/16"-18) standard expanded metal and, for interior ventilator openings, it shall be 5-mm SWD opening, 20-gauge (3/16"-20) flattened expanded metal.

11.4 Walls

11.4.1 There shall be only one door to the magazine and any extra doors as commonly found in "seacan" containers shall be welded or otherwise secured and permanently closed.

11.4.2 Repairs shall be made to any weaknesses or openings in the existing walls, both interior and exterior. The interior of the walls shall be completely lined from top to bottom with 8-mm SWD opening, 18-gauge standard expanded metal securely fastened to the walls.

11.4.3 Wall framing (stud) members shall be a minimum of 7.6 cm with "I" or "U" metal channels to form a space or void for bullet-resistant, washed, hard crushed stone or washed coarse gravel (up to 6 mm in size) (refer to subsection 4.11). The metal studs shall run the full height of the walls and be held in place by top and bottom metal channel plates.

Notes:

- Wooden wall studs are not permitted.
- Walls of 15 cm (space/void between exterior wall and interior wall cover) are required if SAND is used as a bullet-resistant material.
- Where weight is a consideration, equivalent ballistic-resistant rigid panels as tested by the Canadian Explosives Research Laboratory (CERL) may be applied to the interior walls. Contact ERD for the approved equivalent thickness of panels to replace the washed crushed stone.
- Refer to subsection 4.5.1 for recommendations on lifting lugs and internal support bracing of walls and roof while transporting any large magazine.

There shall be no horizontal cross members between the vertical studs intervening between the top and bottom plates. To do so would leave a void for the installation of bullet-resistant material later in the construction. Except for the door and ventilators, there shall be no other openings.

The top plate shall be used to secure the wooden ceiling framing members (refer to subsection 11.7.2 - Notes).

11.4.4 Wall studs shall be placed at a maximum of every 40 cm o.c., and the corners shall be framed in accordance with recognized industrial practice. Corner studs will normally require openings cut in the studs, particularly near the top to allow for the pouring of bullet-resistant material.

11.5 Inner Sheathing

11.5.1 The inner wall shall be sheathed with 20-mm fir plywood or 25-mm T&G lumber fastened with plated or other non-sparking sheathing screws at 15 cm o.c. vertically to the metal studs. The heads of the screws must be countersunk.

11.5.2 The inner wall of the magazine shall be fully sheathed. However, the top 30 cm must be removable to permit filling of the space between the studs with bullet-resistant material. This strip shall be fastened with countersunk plated wood screws. The bottom 15 cm may also be constructed in the same manner to permit removal of this material.

11.6 Floor

11.6.1 The existing floor is to have hardwood a minimum of 5 cm thick. If less than 5 cm thick, then a sufficient thickness of hardwood shall be installed or, alternately, a durable non-sparking surface material suitable for rolling materials-handling equipment shall be added to raise the floor up to a minimum of 5 cm thick. In either case, plated sheathing nails or other non-sparking fasteners such as countersunk plated wood screws are to be used. It is recommended that the finished floor be level with the bottom door stop.

11.7 Ceiling[#8]

11.7.1 Since the roofs of "seacan" containers in general do not provide theft-resistance, a ceiling that provides such protection is required.

11.7.2 Ceiling framing members shall be either 5 x10 cm lumber placed on edge or be of a metal "I" or "U" channel (minimum 7.6 cm on edge), wedged between the roof and the top wall plates at 40 cm o.c. and securely fastened in position to the vertical metal studs.

Note: It is generally not practical to add bullet-resistant material to the ceiling (roof) area and at the same time keep the integrity of the exterior roof in tact; thus, such a modified container may not be acceptable in the province of Quebec. If feasible, the framing members shall be of metal "I" or "U" channels to a minimum of 7.6 cm high (on edge) to provide for the addition of bullet-resistant material.

11.7.3 Two layers of 20-mm sheathing plywood sandwiching a layer of expanded metal shall be inserted between the underside of the ceiling frame members and the roof, all firmly held in position by metal strips at the seams.

If the method described above is impracticable, each layer of the sandwich shall be independently fastened to the preceding layer. The first layer shall be fastened with countersunk non-sparking wood or metal screws to the ceiling framing members at 30 cm o.c. The layer of expanded metal shall be firmly fastened to the first layer. The last layer of sheathing fir plywood shall be laid in the opposite direction to the first layer to provide an overlap of joints, all fastened with non-sparking lag screws into the framing members at 30 cm o.c.

11.8 Door Frame and Sill

11.8.1 The door frame and sill shall be similarly constructed and conform in all respects with that of a Type 4 magazine as specified in subsection 4.8. As an alternate for the sill plate only, on an ISO container or seacan under 6 m (20'), a 90-mm (3.5") x 63.5 mm (2.5") angle iron may be substituted. It must be noted when adopting the angle sill plate that there is more of a potential for warpage of the frame since the door and frame may not act as a unit due to settling and extreme temperature shifts.

Notes:

- Refer to subsection 4.8.1 (first note) recommending the extension of the door sill and header to minimize unit distortion due to extreme temperature cycling and magazine settling.
- A seacan larger than 6 m (20') will require the full tubular door frame as outlined in subsection 4.8.
- Refer to subsections 4.14 and 11.10.1 for an important note regarding full welding of the eavestrough directly over the door.

11.9 Door, Lock(s), Hinges and Ventilators

11.9.1 The door, lock(s), hinges and ventilators for a Type 11 magazine shall conform in all respects with those of a Type 4 magazine as specified in subsections 4.8 to 4.10.

Note: Refer to subsection 4.16.1 for an alternate locking method while in the transportation mode.

11.10 Bullet-Resistant Materials, Stacking Line and Interior/Exterior Finish[#8]

11.10.1 Bullet-resistant materials, the stacking line, and the interior and exterior finish of a Type 11 magazine shall conform in all respects with those of a Type 4 magazine as specified in subsections 4.11, 4.12, 4.13 and 4.14, with the latter making reference to the importance of an

installed eavestrough directly over the door for continued smooth operational efficiency during freeze/thaw cycles.

Note: A Type 11 magazine is NOT equivalent to a Type 4 magazine since the thinner exterior wall of a Type 11 magazine has lower ballistic resistance and is more susceptible to a forced attack.

SECTION 12 - TYPE 12 MAGAZINE
(Unique)

12.1 General

12.1.1 Magazines built to this general standard tend to be "unique" and may be approved as permanently located or portable magazines for the storage of industrial explosives, including detonators. The design may be a novel approach for a portable or permanently located structure based on either an existing building, structure, or part thereof, converted by modifying some or all components, or be of a totally unique design appropriate to the situation.

Note: The execution of the design must be approved in writing by ERD and be described in detail on the magazine licence.

12.2 General Requirements

12.2.1 The unique characteristics of any explosives storage structure may need to be bullet-resistant, non-combustible construction, theft-resistant (i.e. with force (punch/pry), drill and torch characteristics), weatherproof and ventilated to the degree dictated by its particular circumstances and agreed to, in writing, by ERD.

12.3 Basic Construction

12.3.1 The foundation (floor), walls, roof, door(s), lock(s) and ventilators shall be left to the ingenuity of the designer/builder and shall conform as closely as possible with the appropriate magazine type, as outlined in these *Storage Standards*, provided they meet the general requirements of subsection 12.2.

Table of Magazine Capacities

NOMINAL OUTSIDE DIMENSIONS (metres)			NOMINAL CAPACITY	
Length	Width	Height	By Weight (kilograms)	By Standard Case (25 kg) OR By Detonator Case (max. 1000 per)
A)		Magazines Serviced From Outside Only		
1.2	0.9	0.9	250	10
1.2	1.2	1.2	250	10
B)		Walk-In Magazines		
1.2	1.2	2.3	500	20
1.5	1.5	2.3	1 250	50
1.8	1.8	2.3	2 500	100
2.4	2.4	2.3	5 000	200
3.7	2.4	2.3	7 500	300
4.9	2.4	2.3	10 000	400
6.1	2.4	2.3	12 500	500
6.1	3.7	2.3	20 000	800
7.3	3.7	2.3	25 000	1 000

Note: For larger magazines, use a factor of 1.2 m^2 of floor area for each 1000 kg of explosives.

APPENDIX B
PART I

List of Approved Locking Devices for Magazines

Notes:

- From time to time, the locks specified below are either no longer available, have no replacement, or have been improved and given new numbers. If these locking devices have been improved, THEY MAY ONLY BE REPLACED WITH THEIR UPGRADED REPLACEMENT. In such cases, it must be demonstrated, IN WRITING, by a certified master locksmith or manufacturer that the padlocks and/or cylinders have met the high-security criteria that are consistent with the particular manufacturer's approved lock series noted below. Failure to do so may result in the lock mechanism being rendered UNACCEPTABLE by ERD.
- In all cases, the Royal Canadian Mounted Police (RCMP) will be consulted.
- Locks#10 specified on this list may not necessarily be approved in some provinces for vehicles transporting explosives. Check with your provincial authority.

1) LOCKS AND CYLINDERS (TYPICALLY FOR WALK-IN MAGAZINE DOORS):

A) Mortise Locks (see Section C below for approved required cylinders):

MANUFACTURER	SERIES	COMMENT
Best Deadbolt	Series 34H, 38H or 39H	High-security mortise cylinder required with this lock.
Schlage Deadbolt	"L" Series	High-security mortise cylinder required with this lock.

B) Rim Locks (see Section C below for approved required cylinders):

Medeco Dropbolt	D-10 Series	Jimmy resistant. Available c/w Bodyguard.
Yale Deadbolt	112 1/4	No thumbturn inside - key only. Use with rim mount lock cylinder.

C) Cylinders:

Abloy Disklock Pro and Protec Series	5475 or Protec CY 402N 5476 or Protec CY 403N 5404 or Protec CY 5150N all with key controls	Mortise Rim/mortise
Medeco Biaxial	10W0100 10W0400H	Mortise Rim
Schlage Primus	20-500	Mortise
ASSA	Twin V10 c/w side bar coded key	Rim

Notes:

A) All walk-in-type magazine doors or smaller versions will require the key to be extended. It is recommended that the key not only be soldered, but also pinned via a rolled spring pin.

B) All lock cylinders require six (6) pins that do not bear any coding directly or indirect. They should have erratic key bitting, i.e., key code 152749 or 416381.

C) Restricted key control is required.

D) Approved lock cylinders may have either a centre or offset tailpiece. It is recommended that the fabricator have the lock cylinder in possession prior to fabricating the lock assembly.

2) PADLOCKS (TYPICALLY FOR PORTABLE MAGAZINES):

MANUFACTURER	SERIES	COMMENT
Abloy Disklock Pro Abloy Protec	PL 240/25 & PL 250/25 PL 340, PL342, PL350 or PL362	Shackle clearance 25 mm. Shackle diameter 10 mm. No brass bodies allowed.
American Lock	780 R (KD) & 790 R (KD)	Not by-pass resistant. Requires restricted keyway option, 6-pin cylinder, and keyed different (KD).
	2010 R (KD)	Shackleless padlock c/w 6-pin and restricted keyway plus key control program required. For use with guarded hasp #800 only - welded in place.

Tufloc	Speciality Padlock (see Note 6 below) Model 50 or 60 Series.	Bolt method preferred over welding.
Medeco	MetroLock 52-7	c/w biaxial cylinder and key control program.
Master Lock (ProSeries)	6230W7000 6270W7000	 Shackleless round c/w 6-pin Pro Series cylinder required. For use with No. 770 guarded hasp only - welded in place.

Note: Plastic covers to protect the keyway against the elements are available for most padlocks.

REMARKS:

1) Most padlocks listed in Appendix B will typically incorporate the following design features to guard against forced entry:

   - case hardened boron alloy steel shackle, minimum 10-mm diameter c/w minimum 25-mm shackle clearance;
   - locking toe and heel by ball bearings;
   - solid steel case - no brass bodies permitted;
   - positive locking feature on core plug
     (Note: Most manufacturers are going to removable plugs);
   - environmental considerations re: protect key with plate;
   - restricted key control entry (refer to remark no. 2 below);
   - surreptitious compromise;
   - anti-drill feature;
   - by-pass-resistant; and
   - 6-pin high-security cylinders that do not bear any coding directly or indirect (should have erratic key bitting, i.e., key code 152749 or 416381).

Notes:

- **The above criteria are intended as a guide only for certified master locksmiths and manufacturers.**
- **In all cases, the RCMP will be consulted for specific padlocks and core recommendations not included in the approved list. Manufacturing technical specifications must be included with any request.**

2) Most locks and cylinders listed above have restricted keyways, which means there are controls on their duplication and availability generally after identification and signature through the manufacturer or a locally authorized certified master locksmith designated by the manufacturer.

3) Although the percentage of stolen explosives may seem small when compared to the quantity consumed annually, ERD requires all licensees to implement other security measures (in addition to restricted keyways and being keyed differently) to eliminate or discourage the theft of explosives solely with a key. Key and lock control could be accomplished by:

   - issuing keys to a limited number of employees who would be responsible for the control and access to magazines;
   - removing the key codes from the locks to prevent copying;
   - periodically changing all the locks and/or cylinders, thus requiring new keys;
   - not leaving keys on clipboards in offices/trailers (secure the keys in locations where no one would have access except designated persons); and
   - never leave keys concealed on or near magazines as THIS IS THE FIRST PLACE A THIEF WOULD LOOK.

For additional information, refer to Part I, subsection 1.10.7, and Part II, Section 5.0.

4) Mortise locks are without mortise cylinders since high-security mortise cylinders are now required.

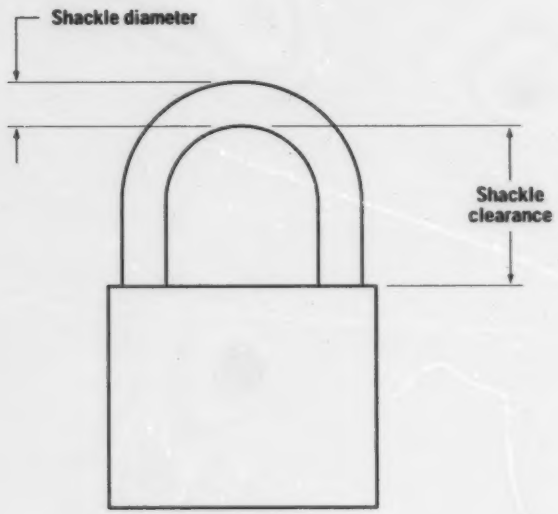
5) Locks are by series; therefore, applicable cams, etc., will require identification when hardware is chosen.

6) The Series 60 TUFLOC/MEDECO system is approved as a replacement for all mortise and rim mount locks and padlocks specified above.

The Series 50 TUFLOC/MEDECO system is approved as a method of padlocking Type 6 and Type 10 magazines. When the opening is 1.2 m or less, a single TUFLOC may be installed at the centre.

With either series, the bolt method is preferred over welding for better resistance to a sledgehammer type attack. Lock protectors (hoods) may be omitted only when the body is fitted with the optional extra deflection top. The manufacturer offers as options a tapered central bolt and a key-retaining feature. Both are highly recommended with the tapered bolt catering to misalignment and the key-retaining feature protecting against leaving the magazine unlocked. Much of the benefit of the MEDECO cylinder is lost if duplicate keys are readily obtainable. Minimum key control at Level II registered is preferred.

7) For prices and technical information, contact a certified master locksmith or deal directly with the manufacturer.



Magazine Heating Guidelines
(includes wiring and insulation)

There are a number of systems to choose from when considering the heating of magazines, namely electrical, or a combination of electrical and glycol, or hot air from an oil or gas-fired furnace. The electrical system or combination of electrical and glycol is preferred whenever an adequate power source is available. Oil or gas-fired furnaces are to be contemplated only when there is no other alternative. Industrial experience has shown that the desired inside temperature range during cold weather is between 10 and 18°C.

GENERAL ELECTRICAL REQUIREMENTS

The following general requirements apply to electrical installations:

a) Overhead power transmission lines and service lines must not pass within 15 metres of a building that contains explosives.

> Note: Power source lead-ins shall be placed underground at least 15 metres from the building with no overhead electrical (i.e., no masts) connections permitted.

A lightning ground rod must be installed at the base of the last overhead power transmission pole. The main switch gear will be located at the last transmission pole in a weatherproof enclosure.

b) The supply of electricity to a building that contains explosives shall be controlled by a master switch from the pole closest to the building. Surge protection is recommended for lightning.

c) The electrical wiring within the building must be in aluminum conduit (provides mechanical protection and non-rusting) or plastic-coated flexible armoured cable (TECK 90) with the latter requiring additional mechanical protection, particularly on the vertical walls, to prevent physical damage from pallets, stacked boxes, etc. Ideally, the wiring should be incorporated in the walls.

In the case of electrical enclosures, these are to be mounted outside the magazine where feasible. When not feasible, all switch boxes may be classed for a watertight, dust-tight and corrosion-resistant equipment rating (that which would pass CEMA/NEMA 4X hose test). The installation must be efficiently bonded throughout and grounded at the point of entry into the building. The actual grounding is to be made outside the building. The entire wiring circuit will incorporate a ground fault interrupter.

Any insulation considerations (e.g., in ceilings/walls) must have a FLAME SPREAD RATING of 25 or less as defined in the *National Building Code of C nada* (NBC). AF Rigid Fibreglass Insulation, type AF 545 or AF 570, by Fiberglas Canada Ltd. (Owens Corning Canada),[#11] would be appropriate for such an application. Closed-cell extruded polystyrene rigid insulation is not recommended as it flames and contributes to a temperature rise. The latter type of insulation may only be used in exceptional cases when combined with *noncombustible* materials, as defined in the NBC, when there are concerns for flammable vapours given off by some products that have the potential to accumulate and be absorbed and trapped. Seek the advice of ERD prior to proceeding with this latter option. All insulation must be protected from mechanical damage.

ELECTRICAL HEATING/GLYCOL INSTALLATIONS

Electrical heating can be done in two ways. The first involves the installation of a glycol heat exchanger outside the building and the circulation of the hot glycol-water solution into the building and through unit heaters mounted at ceiling level. The electrical motors on these unit heaters must comply with Class 2, Division 2 of the *Canadian Electrical Code* (CEC).

An alternate arrangement is a con.ection heater(s) mounted horizontally or an electric air heater blower unit(s) electrically classified to Class 2, Division 2 of the CEC.

In both cases, the heaters need to be mounted well above the stacking line and must have mechanical protection. The mechanical protection should be an expanded metal mesh guard with sufficient stand off from all exposed surfaces to provide adequate convection and dissipation of the heat and to prevent the direct contact of explosives with the heater.

In both cases, a redundant high temperature limiting control must be installed or accompany the unit (often built-in) to prevent a runaway situation should the thermostat fail.

HOT AIR FURNACE (OIL/GAS)

The hot air furnace, be it oil or gas (natural/propane), must be located in a fire-resistant building sited at least 8 metres from the magazine. The fuel tanks should be located on the surface, at a grade lower than the magazine itself to minimize or prevent the spread of a fire to its contents, and be designed to meet provincial environmental considerations. The quantity of fuel should be kept to a reasonable limit.

> Note: Under no circumstances must oil or gas (natural/propane) flow towards the magazine in the event of a leak.

A redundant high temperature limiting control must be included in the heater and in the hot air duct between the heater and the magazine, in addition to the usual magazine thermostat.

In the event of a sudden temperature rise, the magazine must be protected by a fire damper activated via a fusible link or other safety device to close and seal the duct as near to the furnace as reasonable.

Note: Recirculated heated air from a forced air system is not recommended. Consult ERD for a derogation if considering such an installation.

In the latter case where oil or gas is a consideration, a 10-lb dry chemical fire extinguisher must be mounted in the furnace room. A fire extinguisher is recommended in other electrical heating situations.

Note: Never use a fire extinguisher to fight fires involving explosives.

A protective alarm system, which may be audio or visual, should be considered as an adjunct where failure to heat the explosives during cold weather is a concern.

Endnotes

#1 (noted in ssG.2.1)
Each wall or door configuration calling for bullet resistance has been tested and proven to stop both soft-point (hunting) and full-jacketed (military) bullets of 30.06 calibre, 5.53 mm and 7.62 mm Ball FMJ calibres fired point blank (15 m).

#2 (noted in s1.8)
Quebec statute requires access to a crawl space to be closed off with wire mesh.

#3 (noted in ss1.10.2, ss4.1.1, ss4.11, ss4.5.1 and ss11.2.2)
This option may not be permitted by the Quebec statute An *Act Respecting Explosives* (S.Q. 1970, ch. 13) for use within that province. Check with Quebec authorities.

#4 (noted in sG.7 and ss1.10.6)
Whenever extra security conditions exist, such as guards on duty during off hours, other locks, locking arrangements and other electronic surveillance measures may be authorized within the terms of granting the licence.

#5 (noted in ss1.10.6 and ss1.10.7)
For use in Quebec, locks and lock cylinders must be of a type approved by the Quebec police force.

#6 (noted in ss1.10.8, ss1.10.9, ss1.10.10 and ss11.3.2)
Quebec statute An *Act Respecting Explosives* (S.Q. 1970. ch. 13) requires two locks.

#7 (noted in ss1.10.10 and ss11.3.2)
Both locks must be employed at all times. Quebec statute may not allow padlocks. Check with provincial authorities.

#8 (noted in s4.8, ss4.11.1 and ss11.10)
Quebec statute requires either washed hard crushed stone or washed coarse gravel up to 6 mm in size.

#9 (noted in s6.1)
These magazines are not acceptable under the Quebec statute *An Act Respecting Explosives*.

#10 (Appendix B - approved lock list)
Quebec has a separate approved lock list for vehicles transporting explosives.

#11 (noted in appropriate subsections as indicated below):

Hinge - Heavy Duty Institutional (ss9.3.1, ss1.10.12):

Manufacturer: Brookfield Industries, Inc. 99 West Hillside Ave., Thomaston, CT 06787-1433, Tel.: (203) 283-6211, Fax: (203) 283-6123.
R.R. Brink Locking Company, Inc., 500 Earl Road, Shorewood, IL 60431, Tel.: (815) 744-7000, Fax: (815) 744-7020.
Canadian Distributor: Strongbar Industries Inc., 5147 Tomken Road, Mississauga, Ontario, Tel.: (905) 624-5381, Fax: (905) 624-2289.

Hinge - Medium Duty (s6.7.1):

Faucher Industries INC, 2055 Pie IX, Montréal, Quebec H1V 2E1, Tel.: (519) 524-7555.
Marr Weld-on Hinges

Insulation (sG8, Appendix C):

Fibreglas Canada Ltd. (Owens Corning Canada), Customer Service, 5140 Yonge St., Suite 700, North York, Ontario M2N 6T9, Tel.: (800) 521-4907.

Alternate Bullet-Resistant Material (ss9.2.1.1):

Armortex™ by Safeguard Security Services, Inc., 4728 Goldfield, Building #8, San Antonio, Texas 78218, Tel.: (210) 661-8306, Fax: (210) 661-8308.

ArmorLyte™ by Automotive Armor Manufacturing, 1573 East St., Pittsfield, MA 01201, Tel.: (413) 443-2130, Fax: (413) 443-2608.

Concrete Backer Board (ss1.10.3):

Hardibacker by James Hardie, 26300 La Alameda, Suite 250, Mission Viejo, CA 92691, Tel.: (800) 942-7343 or (800) 9HARDIE, Web Site: www.hardibacker.com.
Call for local stocking distributors in Canada.

#12 (noted in sG.2.3)

Standards Council of Canada, National Standards System, CAN-P-1014, December 1987, "Incorporation of Standards by Reference in Regulations - Guidelines for Regulatory Authorities."

Part II. Storage Operation Principles

1.0 GENERAL INFORMATION

This portion of the *Storage Standards* deals with the operational side of the industrial explosives commonly associated with and used in the construction, mining, seismic, and oil and gas well industries. It could equally be applied to any licensed operation or storage unit other than a licensed magazine involving the storage and handling of most types of explosives. Its purpose is to expand on and clarify many areas common to all storage situations and those specifically cross-referenced and mentioned in these standards.

In addition to the following operating principles, there are numerous references in the *Explosives Act and Regulations* that deal with:

- actions required before repairs are done,
- housekeeping,
- posting of instruction placards (refer to Section 6.0 of this Part and Appendices 1 and 2) and original or copy of magazine licence showing quantities,
- no matches or fire-producing devices,
- impact-resistant portable lighting, and
- action to be taken upon the approach of a thunderstorm.

ERD publications such as *Storage, Possession, Transportation, Destruction and Sale*, highlight:

- signage,
- protection against fire hazards,
- opening cases or packages,
- destroying empty cases,
- stacking height,
- turnover of stock, and
- the reporting of thefts or attempted thefts or vandalism in writing,

all of which are generally contained as "terms" of a licence and/or in the Regulations to which all licensees must adhere to.

There are circumstances whereby agreement has been reached between industry and ERD to address unique storage and handling practices for a particular situation or industry as a whole. These have led to the development of "Codes of Practice," which will be addressed by additional terms and conditions of a licence and thus will be referred to by reference in this manual.

2.0 STORAGE RECORDS

Anyone who stores explosives or detonators is required to keep a record of all transactions in and out of the magazine, including "returns." Every precaution must be taken to ensure that no

explosives have been "mislaid" or lost as they may be the cause of subsequent accidents and lead to penalties under the *Explosives Act and Regulations* and the *Criminal Code of Canada.*

Care must be taken to ensure that stocks do not exceed the licence limits for the magazine as the law provides for a penalty when limits are exceeded.

A signature must be obtained for every issue or return of explosives.

The record of stock and subsequent ongoing balance can be in either electronic form or hard copy. The record must be maintained by magazine keepers who receive and issue explosives to themselves, shotfirers or blasters and have the following information:

2.1 For Explosives Received:

2.1.1 The date the explosives were received;

2.1.2 The name and address of the person or company from whom the explosives were received;

In the case of the construction, mining or seismic industries and other related industries using blasting explosives, or the oil and gas well industry using shaped charges, the record shall contain:

2.1.2.1(a) the brand name,
2.1.2.1(b) the cartridge size, or applicable part number,
2.1.2.1(c) the net explosives quantity, and
2.1.2.1(d) the storage licence for sale or use number, i.e., ownership identification number of the lawful owner of the explosives where they are being stored.

In the case of detonators, the record shall contain:

2.1.2.2(a) the brand name and type,
2.1.2.2(b) the period number,
2.1.2.2(c) the delay series, and
2.1.2.2(d) the leg wire or tube length.

2.2 For Explosives Issued/Returned:

2.2.1 The quantity issued and/or returned shall contain the same information as 2.1.1 and 2.1.2; and

2.2.2 The purpose to which the explosive was used.

2.3 For Explosives Sales:

In addition to stock inventory, the operator of a licensed factory or of a storage licence for sale or use magazine(s) containing explosives and detonators is required to maintain a record of all explosive sales issued from the magazine(s). The record shall contain the following:

2.3.1 The date of the transaction;

2.3.2 The quantity of each explosive issued from a magazine or factory;

2.3.3 The name and business address of each purchaser or consignee;

2.3.4 Any one of the following numbers:

2.3.4(a) the federal factory or storage licence for sale or use number,
2.3.4(b) the provincial or territorial magazine licence or permit number, or
2.3.4(c) a voucher to purchase, possess or store explosives number,

of each purchaser or consignee;

Note: For small sales, as in the case of 2.3.4(c), this record may be kept in the Register of Explosives - Voucher to Purchase, Possess or Store Explosives provided by ERD. The instructions on the booklet cover must be strictly followed.

2.3.5 The record of documents presented as proof of identity of the person taking charge of the shipment;

2.3.6 Destination to which each shipment of the explosives is being sent;

2.3.7 The method of transport of each shipment of the explosives, including the security seal number where applicable;

2.3.8 The manifest, bill of lading or shipping order number for each shipment of the explosives;

2.3.9 The name, residential address and signature of the person taking charge of the shipment; and

2.3.10 The record of documents presented as proof of identity of the person taking charge of the shipment.

Note: Aspects of items 2.3.5 to 2.3.10 inclusive are generally covered under Transport Canada's Transportation of Dangerous Goods (TDG) legislation.

Sample inventory control sheets for blasting and detonators are available upon request from ERD.

3.0 COMPATIBILITY GROUPS PERMITTED

Under the UN Recommendations, explosives are classified as Class 1 materials. They are then divided into divisions to indicate their relative hazard. In addition, all Class 1 materials are assigned a Compatibility Group letter to show which materials, when grouped together, will not significantly increase the probability of an accident.

The following mixing of Compatibility Groups must be observed when STORING explosives:

3.0.1 Packaged ammonium nitrate, UN 1942, classification code 5.1, used for making AN/FO of 1.5D, may be kept in a magazine with blasting explosives provided one half of the weight of the ammonium nitrate is considered to be an explosive.

3.0.2 With the written permission of an inspector, no person shall store an accessory with classification code 1.4G or 1.4S with blasting explosives or detonators; however, storage shall be in a secure, dry location.

3.0.3 Detonating cord of 1.1D must always be stored in a blasting explosives magazine (never with detonators) and kept in closed cases. Cut ends of detonating cords must be sealed with masking tape or other suitable tape to prevent dangerous contamination.

3.0.4 Safety fuse of 1.4S, fuse lighters of 1.4S, igniter cord of 1.4G and igniter cord connectors of 1.4G are explosives but present more of a fire hazard than an explosion risk. For this reason, these items must not be stored in magazines with either blasting explosives or detonators but, rather, in a separate dry, secure location that may, in itself, be a magazine.

3.0.5 Exploding bridge wire detonators of classification code 1.1D are to be stored with detonators of 1.1B in a detonator magazine, and not with blasting explosives of category Group D.

4.0 PERMITTED MATERIALS

There are a variety of safe materials and equipment that are permitted in a magazine and used for its handling or operation. These are:

4.0.1 Tools and implements made of fibre, rubber or wood for opening containers.

4.0.2 Brooms and other utensils, with no spark-producing metal parts, used for cleaning a magazine.

4.0.3 Nonferrous transfer conveyors and ferrous conveyor stands and ramps protected by a coat of paint and used for handling explosives. These may be kept in a magazine but shall not be in contact with explosives or explosives containers when not in use.

4.0.4 Implements for marking ownership and portable electronic bar code instrumentation used for inventory control purposes. The latter must possess the proper electrical classification

and be approved in writing by ERD with appropriate precautions to changing batteries outside the magazine. Unless written authorization is given by ERD, such portable electronic equipment shall not be kept permanently in the storage unit.

4.0.5 Reasonable amounts of inner and outer packaging to replace damaged packaging.

4.0.6 A manual pallet-lifter may be kept in a magazine with the written permission of an inspector.

4.0.7 A steel-bladed knife may be used to slit tape on cardboard containers of blasting explosives, but such a knife shall not be kept permanently in the magazine.

When permitted, these items are assigned a designated location and placed there when not in use.

5.0 KEY CONTROL

In order to minimize unauthorized entry, access to a magazine must be limited by key control through procedures, restricted keyways and keys (refer to Part 1 of these standards, subsection 1.10.7, for definition, and to Appendix B).

In this instance, key control is usually associated with mortise locks or padlocks with individual keys, but alternately could mean an equivalent approved locking system guaranteed to provide equal or better security. High-security approved locks are outlined in Part I, Appendix B, of these *Storage Standards.* From time to time, the approved lock list in Appendix B will be updated to represent current technology. Contact ERD to ensure that the latest approved locks are being used for the particular application.

The key control plan shall include:

5.0.1 A minimum number of people having responsibility for control and access to the keys to the magazine as practicable;

5.0.2 Each key is controlled by a controlled numbering system and can only be duplicated by the manufacturer or locally authorized certified master locksmith designated by the manufacturer only after proper identification (usually in the form of an identification card issued at the time of purchase) and a signature;

5.0.3 The keys to the magazine(s) are kept in the custody of a responsible person or in a locked and secure location at all times except when needed to unlock magazines; and

5.0.4 The procedures to be followed should it be determined that a key has been lost or stolen.

Note: It has been customary in leased/rental situations, particularly for smaller portable magazines, for the vendor to provide a set of padlocks with the magazine where the locks are often keyed alike. For security control over the explosives, it is the responsibility of licence holders who utilize a leased/rental magazine equipped with padlocks to SUPPLY THEIR OWN PADLOCKS and, if necessary, with a limited number of keys. Refer to Remarks - no. 3 in Appendix B of Part I for adopting an adequate key control procedure plan.

6.0 INSTRUCTION PLACARDS

6.0.1 Placards for *Instructions - Blasting Explosives Magazine* are illustrated in Appendix 1 of this Part and are available on request. One of these placards must be posted in each blasting explosives magazine.

6.0.2 Placards for *Instructions - Detonator Magazine* are illustrated in Appendix 2 of this Part and are available on request. One of these placards must be posted in each detonator magazine.

APPENDIX 1
PART II

Instructions
Blasting Explosives Magazine

Licence No. _____ Expiry Date _____ Magazine No. _____

MAXIMUM QUANTITY PERMITTED _____

1. STORE ONLY BLASTING EXPLOSIVES, which includes detonating cords, boosters and safety fuse, in this magazine. UNDER NO CIRCUMSTANCES take into or store detonators in this magazine.

2. KEEP interior of magazine CLEAN and free from grit.

3. DO NOT HAVE OPEN BOXES, loose cartridges or spools in the magazine.

4. DO NOT PILE cases higher than the STACKING LINE. Ensure bullet-resistant material is maintained at least 15 cm above the stacking line.

5. Use only APPROVED TOOLS and equipment around explosives and ensure that the explosives are PROTECTED from impact and rough handling.

6. KEEP STOCK FRESH - ensure oldest stock is issued first and that deteriorated, time-expired, unsafe and unwanted explosives are disposed of in a safe manner. DECONTAMINATE as required. Inspect all returns immediately to ensure that they are in a safe condition for storage.

7. Maintain adequate VENTILATION and PREVENT the entry of MOISTURE in the form of rain, snow or ice.

8. Promptly carry out any necessary REPAIRS to the magazine. Before undertaking major repairs, ensure that all explosives are removed to a safe and secure location and that the magazine is decontaminated as necessary.

9. DO NOT SMOKE in or around the magazine, and prevent the taking of MATCHES, LIGHTERS, FLAMMABLE MATERIALS or any article that could spontaneously ignite into the magazine.

10. If artificial light is needed, use an APPROVED FLASHLIGHT or floodlight.

11. CLEAR AND MAINTAIN the ground within at least 8 metres of the magazine of long grass, brush, readily combustible or flammable materials and debris. Ensure empty or used cases are disposed of in a safe manner.

12. Ensure required WARNING signs are posted and maintained.

13. Do not allow SHOOTING or firearms near the magazine.

14. Maintain at all times an accurate INVENTORY of the contents of the magazine and ensure that all cases are MARKED with your magazine licence or distributor assigned permit number.

15. Issue blasting explosives only to authorized persons and obtain a signature.

16. Before leaving, ensure the magazine is securely LOCKED and ensure only AUTHORIZED PERSONS have access to the keys.

17. Upon the approach of a THUNDERSTORM, CLOSE the magazine and EVACUATE all persons from the area for the duration of the storm.

18. Do not load any VEHICLE that does not conform to Part VI of the Explosives Regulations and to the Transportation of Dangerous Goods Regulations.

19. REPORT any fire, accident, break-in, attempted break-in, theft or other incident.

CHIEF INSPECTOR OF EXPLOSIVES

CANADA EXPLOSIVES REGULATIONS

APPENDIX 2
PART II

Instructions
Detonator Magazine

Licence No. _____ Expiry Date _____ Magazine No. _____

MAXIMUM QUANTITY PERMITTED _____

1. STORE ONLY DETONATORS, which include detonating relays and other detonators with safety fuse, detonating cords or shock tubes, in this magazine. UNDER NO CIRCUMSTANCES take into or store blasting or other explosives or non-explosive accessories in this magazine.

2. DO NOT HAVE LOOSE DETONATORS in the magazine.

3. KEEP interior of the magazine CLEAN and TIDY with the various types of detonators readily accessible for selection, issue and inventory.

4. DO NOT SMOKE in or around the magazine, and prevent the taking of MATCHES, LIGHTERS, FLAMMABLE MATERIALS or any article that could spontaneously ignite into the magazine.

5. If artificial light is needed, use an APPROVED FLASHLIGHT or floodlight.

6. Prevent the entry of MOISTURE in the form of rain, snow or ice.

7. CLEAR AND MAINTAIN the ground within at least 8 metres of the magazine of long grass, brush, readily combustible or flammable materials and debris. Ensure used cases and cartons are empty and disposed of in a safe manner.

8. Promptly carry out any necessary REPAIRS to the magazine. Before undertaking major repairs, ensure that all explosives are removed to a safe and secure location and that the magazine is decontaminated as necessary.

9. Ensure required WARNING signs are posted and maintained.

10. Do not allow SHOOTING or firearms near the magazine.

11. Maintain at all times an accurate INVENTORY of the contents of the magazine and ensure that all cases and internal cartons or open cases are MARKED with your magazine licence or distributor assigned permit number.

12. Issue detonators only to authorized persons and obtain a signature.

13. Before leaving, ensure the magazine is securely LOCKED and ensure only AUTHORIZED PERSONS have access to the keys.

14. Upon the approach of a THUNDERSTORM, CLOSE the magazine and EVACUATE all persons from the area for the duration of the storm.

15. Do not load any VEHICLE that does not conform to Part VI of the Explosives Regulations and to the Transportation of Dangerous Goods Regulations.

16. REPORT any fire, accident, break-in, attempted break-in, theft or other incident.

CHIEF INSPECTOR OF EXPLOSIVES

CANADA EXPLOSIVES REGULATIONS

Part III. Rulings and Policy Decisions for Magazines Built Before May 31, 2001

The following is of special importance to those who have magazines that were built to the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators.*

This document comes into force on May 31, 2001.

It has a number of implications for existing magazines licenced by ERD to improve the security of explosives. As a result, a number of policy decisions have been taken following the many comments and suggestions received from industry during the comment stage.

Notes:

- The program for conversions and updates is to be completed no later than May 31, 2011.
- Refer to subsection 1.0.4.7 of this Part III for Risk Area Categories and timing by province/territory.

WHY THE CHANGE?

There has always been a requirement for physical security of explosives for obvious reasons. The *Magazine Standards* were last reviewed in detail in 1982. Since that time the design technology for secure vaults has changed little but, more importantly, the skill level and tools used by those who have an intent to break and enter have changed significantly, resulting in the lock mechanism being quite vulnerable to a force attack. Modern battery-powered tools have reduced the security of magazines to the extent that they now only provide protection against casual theft. This has been one of the main driving forces behind the changes. Following a number of breaches on magazines over the years, it gets increasingly difficult to defend outdated technology on magazines that last for many years. The single bolt on most walk-in magazines (double in Quebec) has been identified as the weakest link in the locking mechanism, as have most padlocks previously approved under the former1982 magazine standards. As a result, some changes are required to upgrade existing magazines to improve the security of explosives.

Many of the changes required will come into effect over the next five 5 to 10 years, i.e., from May 31, 2006, to May 31, 2011, respectively, depending on the risk area category and province/territory (refer to subsection 1.0.4.7 of this Part III).

1.0 CHANGES TO MAGAZINES (GENERAL)

1.0.1 Doors and Frames

1.0.1.1 All magazine doors and frames are to be retrofitted with the newer door design, with exceptions for magazines built to the standards required by Quebec statute and used in provinces/territories other than Quebec. In addition, Type 6 cupboard-style doors are exempt from this retrofit (refer to Illustration 16 of Part I).

Implementation in Quebec is nominally within a five-year period ending on May 31, 2006. Exceptions may apply - consult a regional explosives inspector for details and refer to subsections 1.0.1.3 and 1.0.4.7 of this Part III.

1.0.1.2 Magazines built to Quebec statute standards may utilize the existing laminated door design but the newer lock train, including stiffening of the door, e.g., angle and the frame upgrade, will be required.

1.0.1.3 Electronic security/fencing will not be considered as an alternate to replacing the door/frame over the long term. However, a one-year grace period will be added and granted to magazines in high-risk areas only to those firms who have such upgrades in place as of May 31, 2001. As a result, magazine upgrades must be completed no later than May 31, 2007.

Magazines with successful break-ins, whether explosives are stolen or not, will require conformity with these new standards within two months of the date of the incident.

1.0.1.4 Existing sliding doors and their locking mechanisms are unique but, ultimately, the design must have similar security measures, e.g., force (push/pull/pry), drill, punch and torch characteristics, as well as ballistic resistance characteristics designed into them, as is required for swing doors.

The fabricator/licensee must demonstrate that the above has been met and submit the design and/or photographs to ERD for approval and continued use. Defined risk area and timing will apply for any required upgrades to existing doors. Refer to subsection 1.0.4.4 for implementation plan requirements and to subsection 1.0.4.1 for the required action following an attempted or successful break and enter.

1.0.1.5 If there are two or more doors on an existing magazine that provide independent access to the magazine from the exterior, then both doors must be upgraded to meets these standards (refer to subsection 1.10.1).

1.0.2 Walls

1.0.2.1 All existing magazines with 5 cm (2") of gravel or sand in the walls will be grandfathered.

ERD will advise only to upgrade with gravel or sand to the new magazine standards when a magazine is being upgraded. If there is a rash of bullet threats, then ERD will move from an

advisory position to a mandatory change re: due diligence. This applies mainly to Type 4 steel magazines but could apply to other types.

1.0.3 Locks and Cylinders

1.0.3.1 All padlocks and replaceable lock cylinders previously specified under the *1982 Magazine Standards* and subsequently in Bulletin #25 (lock list revisions) are grandfathered for a period of three years ending May 31, 2004, for padlocks, and for five years ending May 31, 2006, for the higher-security deadbolt-type lock and lock cylinders (refer to Part I, Appendix B, for guidance).

An exception is made for Master 15 and Papaiz CR60 padlocks, which will require replacement within one year, i.e., compliance by May 31, 2002, with the higher-security locks.

1.0.4 Miscellaneous

1.0.4.1 If there is a break and enter or an attempted break and enter, then the magazine door and frames must be updated within two months from the date of the incident, as outlined in Part III, subsections 1.0.1.1, 1.0.1.2 or 1.0.1.4 above.

This requirement will apply to all magazines on the affected site. An implementation plan will be submitted to ERD within 14 calendar days following the incident.

> Note: Should ERD become aware of an attempted break and enter (B&E) or a successful B&E after the fact, i.e., an event not reported in writing to the Chief Inspector of Explosives as required under the terms of the licence, then the licence may be revoked until such time as the required changes are made.

1.0.4.2 ERD has adopted a policy to not differentiate between 1.1D and 1.5D explosive sensitivity for storage considerations with the exception of remote areas generally in the north as defined in Part I, subsection 11.1.1, of these revised *Magazines Standards*.

1.0.4.3 Purchase and Possession Permits will be restructured in the next re-write of the *Explosives Act and Regulations* to allow for storage in licensed storage only. This comes as a result of poor storage practices and abandoned explosives.

1.0.4.4 All licensees, in conjunction with the appropriate regional office, must specify on their licence by May 31, 2002, the agreed-upon final date to comply with these standards, taking into account the risk areas and timing identified in subsection 1.0.4.7 of this Part. This requirement applies to separate magazine licences issued by regional offices and magazines forming an integral part of a factory licence issued by ERD headquarters.

ERD regional offices will manage the aspect of finalizing the dates for all sites regardless of whether the licensee is a holder of a magazine licence or a factory licence.

It is expected that licensees will provide an "Implementation Plan" to ERD for any upgrades to meet the requirements outlined in this Part III for existing magazines. The implementation plan

will be a mandatory requirement after May 31, 2003, that will be reviewed and updated annually. The document is not intended to be final, but to serve as a guide for both parties to illustrate that some progress/commitment is being made towards the necessary changes to improve the security of explosives.

1.0.4.5 The Magazine Numbering System (code/tag) as outlined in Part I, Section G.11, will be implemented only when a new door is installed on an existing magazine as will any other required changes as noted in this Part III for the particular magazine type.

For new magazines built to the standards noted in Part I, tags will be issued by ERD and generally installed by the manufacturer/fabricator. The tag identification number (code) is to be shown on the outside of the magazine. The manufacturer/fabricator is to notify ERD when a tag is required.

For existing magazines, the tag will be installed by either the manufacturer/fabricator or the magazine owner upon notification to ERD. The corresponding number is to be shown on the exterior of the magazine.

Refer to Section G.11 for tag location on the door/lid and exterior of the magazine.

1.0.4.6 Design details of the revised laminated door design will be controlled and issued to approved shops or facilities on a "need to know basis" as outlined in Part I, Section G.13, and in subsection 1.10.2. Contact ERD for an application package to pursue this matter further. There is a fee associated with such drawings.

1.0.4.7 Risk Area Categories and corresponding time lines defined by province/territory:

High-Risk Areas - Completion by May 31, 2006 (5 years)	Medium-Risk Areas - Completion by May 31, 2008 (7 years)	Low-Risk Areas - Completion by May 31, 2011 (10 years)
British Columbia	Manitoba	Newfoundland and Labrador
Alberta	New Brunswick	Northwest Territories
Ontario		Nova Scotia
Quebec		Prince Edward Island
		Saskatchewan
		Yukon
		Nunavut

Source: RCMP Bomb Data Centre statistics for bombing incidents and explosive thefts by province.

- Conversion and upgrades are to commence May 31, 2001, and to be fully completed no later than May 31, 2011, i.e., within 10 years with no extensions permitted.

- Mobile, zone or rental magazine(s), regardless of magazine type, will default to high risk with no time extensions, i.e., completion by May 31, 2006. The phasing out of Type 7 magazines falls into this category (refer to Part III, subsection 7.0.1).

- Known break and enters (B&Es) at a site in the last 10 years will be fast-tracked to a high-risk category with upgrades/conversion to be completed by May 31, 2006.

- Some instances, such as remote northern areas of some provinces/territories and the phasing out of Types 2, 3 and 5 magazines may, depending on the individual circumstances, warrant a move from a higher risk category to the next lowest risk category. These may only be approved by the appropriate ERD regional office, in writing, taking into consideration the size of the population at risk, known B&Es over the past 10 years, site access in summer and winter, additional security measures in place, etc.

  Regional explosives inspectors will consult with local police authorities where warranted.

  If approved, such extensions from the nominal risk category indicated in the table above, along with the rationale, are to be recorded on the licence. If conditions change or deteriorate at a particular site, then the agreed-upon grace period could be reduced or eliminated.

- For related information, refer to subsections 1.0.1.1, 1.0.1.3, 1.0.3.1, 1.0.4.1, 6.0.4 and 6.0.6 of this Part III.

- Contact the appropriate ERD regional office if additional details are required.

1.0.4.8 Frequently, the upgrading of a magazine(s) will require open flame and welding on the unit at its normal storage site. The procedures outlined below are to be followed in performing the required "hot work," with the licensee having total responsibility for ensuring they are carried out.

- Obtain a blanket "Open Flame/Welding Permission" from ERD to cover the installation of door upgrades, etc., for the magazines commencing at some future date.

- At the time of the modification(s), notify the appropriate regional office either by phone, e-mail, letter or fax of the pending installation and request authorization to proceed. Reasonable lead time for ERD to respond is requested, with a minimum of two to three working days recommended.

- Before work commences, the crew performing the work is to receive training on acceptable safe work practices and the dangers associated with performing "hot work" in areas where explosives have been previously stored.

Note: Only spark lighters are to be used. No matches or other fire-producing devices are permitted on site.

- As a minimum, the magazine being worked on will be emptied. The contents will either be stored in another magazine or in a guarded vehicle a safe distance away while the renovations are taking place.

> Note: When performing "hot work" on a magazine site where there is more than one magazine containing explosives, it will not be necessary to empty the remaining magazines that are not being worked on. However, the licensee must ensure that the doors of magazines containing explosives are closed and properly secured.

- When empty, ensure the magazine has been properly decontaminated and is completely free of any residue from explosives, oxidizers or other flammable chemicals, such as NG from nitroglycerine-based products or leaked fuel oil from ammonium nitrate and fuel oil (AN/FO) bagged products.

- The licensee or senior delegate is responsible for inspecting the magazine prior to any work being performed to ensure it is free of any explosive residue, thus authorizing (i.e., signing off) the commencement of the "hot work."

> Note: Most firms have instituted a "Hot Work Permit" procedure for this process.

- Have on hand any necessary fire blankets and a minimum of two 10 BC rated portable fire extinguishers.

- Following the hot work modifications, a minimum of one hour fire watch is required. A final inspection shall be conducted four hours later before returning any explosives to the magazine.

- All unusual incidents resulting from these modifications are to be reported to ERD.

2.0 CHANGES TO TYPES 1 AND 8 MAGAZINES (BLOCK WALL/REINFORCED CONCRETE)

2.0.1 All wall construction on existing magazines will be grandfathered.

2.0.2 The doors in these magazines are to be upgraded to the new revised magazine standards with the exception of the door frame, which will be grandfathered. Refer to subsection 1.0.4.4 for the required implementation plan.

2.0.3 The sliding door or double-door construction of existing magazines will be reviewed on a one-on-one basis for security and, when satisfied, ERD will issue a tag (refer to subsections 1.10.1 and 1.10.5 of Part I and to subsections 1.0.1.4 and 1.0.1.5 of this Part III).

3.0 CHANGES TO TYPES 2 AND 3 MAGAZINES (STUD FRAME)

3.0.1 Applications for new magazines of these types will not be accepted after May 31, 2001.

3.0.2 Existing magazines will be phased out over a 5-year period for a high-risk area, over 7 years for a medium-risk area, and over 10 years for a low-risk area commencing May 31, 2001, assuming they are in good condition as deemed by an explosives inspector.

Refer to subsection 1.0.4.4 of this Part III for guidance.

4.0 CHANGES TO TYPE 4 MAGAZINES (STEEL)

4.0.1 All existing magazine walls, be they 5 cm (2") gravel or sand, will be grandfathered (refer to Part III, subsection 1.0.2.1, above).

4.0.2 All new magazines constructed after May 31, 2001, may continue to have sand in the walls in lieu of washed crushed gravel but will result in thicker wall requirements.

> Note: Ballistic resistance for SAND requires walls 15 cm (6") thick verses 7.60 cm (3") for gravel. This shall apply for all regions of the country.

4.0.3 Alternate lightweight materials that demonstrate equivalent ballistic resistance will be considered by ERD following testing by the Canadian Explosives Research Laboratory (CERL) (refer to subsections 4.11.1 and 9.2.1.1).

4.0.4 All previously specified deadbolt lock and lock cylinders under the *1982 Magazine Standards* and subsequent Bulletin #25 (lock list revisions) are grandfathered for a period of five years ending May 31, 2006. In many cases, the existing deadbolt-type lock housing will meet the standards set out in Part I, Appendix B, but the lock cylinder itself, in all likelihood, will need to be changed to meet the higher security requirements (refer to Part I, Appendix B, for guidance).

5.0 CHANGES TO TYPE 5 MAGAZINES (MODIFIED TRAILER/RAIL CAR)

5.0.1 Applications for new Type 5 magazines will no longer be accepted after May 31, 2001.

5.0.2 Existing magazines are to be phased out over a 5-year period for high-risk areas ending May 31, 2006, over 7 years for medium-risk areas ending May 31, 2008, and over 10 years for low-risk areas ending May 31, 2011, assuming they are in good condition as deemed by an explosives inspector.

Refer to subsections 1.0.4.4 and 1.0.4.7 of this Part for guidance.

6.0 CHANGES TO TYPE 6 MAGAZINES

6.0.1 There have been a number of thefts involving Type 6 magazines from UNATTENDED OVERNIGHT storage. ERD is currently reviewing the continued use of these magazines for overnight storage and thus will gather statistics over the next five years, i.e., until May 31, 2006. If the statistics do no not change appreciably during this timeframe, ERD is considering a move to eliminate them as a stand-alone magazine for overnight storage for many situations and to move industry to a Type 4 magazine, as is currently required under Quebec statute.

Exceptions will be permitted for Type 6 magazines inside buildings, ski hills, drill rigs and day boxes.

6.0.2 ERD has adopted a policy whereby if a Type 6 magazine has been removed or experienced a break and enter, the magazine must be replaced within two months from the date following the incident with a higher-security Type 4 or 4S magazine at the affected location. The licensee must submit an implementation plan within 14 calendar days following the incident. The change to a higher-security Type 4 or 4S magazine will be required for all magazines at the affected site after May 31, 2001.

6.0.3 After May 31, 2004, ERD will no longer permit Type 6 magazines to be tied down with wire cable or chains to a substantial object, e.g., a tree, as a means of securing the magazine(s) for unattended overnight storage.

Existing magazines will need to be modified to weigh at least 200 kg when empty or have a permanent internal tie-down through the bottom of the magazine to a suitable heavy base by May 31, 2004, as defined in Part I, subsection 6.9.

6.0.4 Staples and hasps on existing magazines require a change to stainless steel within the next three years, ending May 31, 2004, as outlined in Part I, subsection 6.7.1. This requirement supersedes the provincial risk category and timing indicated in Part III, subsection 1.0.4.7.

Upgrades to the new hinges (refer to subsection 6.7.1 and Illustration 17) are not required if a security flange or lug(s) currently exist. If no such security flange or lug(s) exists, then both the hinges and a means of providing the necessary security for the lid will be required.

Note: A security flange or security lug(s) on the inside of the lid behind the hinges prevents the lid from being removed if the hinges are cut off or if the hinge pins are removed.

6.0.5 All padlocks and replaceable cylinders previously specified under the *1982 Magazine Standards* and subsequent Bulletin #25 (lock list revisions) are grandfathered for a period of three years ending May 31, 2004 (refer to Part I, Appendix B, for guidance).

Refer to subsection 1.0.3.1 of Part III for exceptions applying to Master 15 and Papaiz CR60 padlocks, which must be replaced by May 31, 2002, with higher-security padlocks.

6.0.6 Wood/mesh laminate magazines built to the *Revised 1982 Magazine Standards for Blasting Explosives and Detonators* and consisting of either plywood with wire mesh laminate or plank and plywood with wire mesh laminate, both covered with 20-gauge galvanized steel, will no longer be permitted as an option for new magazines commencing on May 31, 2001.

Existing wood/mesh laminate magazines will be phased out over a period of three years, i.e., completed by May 31, 2004, for all provinces/territories regardless of the region. This requirement supersedes the provincial risk category and timing indicated in Part III, subsection 1.0.4.7.

7.0 CHANGES TO TYPE 7 MAGAZINES

7.0.1 ERD has adopted a policy to phase out Type 7 magazines (two Type 4 compartments on a skid) over the next five years, ending May 31, 2006. New revised Type 9 magazines, as outlined in Part I of these standards, will be encouraged as a replacement. Refer to subsection 1.0.4.4 for the required future implementation plan dates.

7.0.2 For continued use, a Type 7 magazine must be modified within five years, ending May 31, 2006, to the new Type 4 magazine standards, including the door, as outlined in these revised standards. The magazine will be reclassified as a Type 4 magazine once the modifications are completed. Refer to subsection 1.0.4.5 of this Part III for the installation of numbered tags.

8.0 CHANGES TO TYPE 9 MAGAZINES

8.0.1 For these newly defined magazines, alternate lightweight materials that demonstrate equivalent ballistic resistance will be considered by ERD following testing by the Canadian Explosives Research Laboratory (CERL) (refer to subsection 9.2.1.1).

8.0.2 For existing magazines, ERD has adopted a policy whereby the door will need to be upgraded to that specified in Part I, subsections 4.8 and 4.9, within five years, ending May 31, 2006.

8.0.3 All wall construction on existing magazines will be grandfathered.

8.0.4 ERD will continue to encourage the use of Type 4 magazines in high-risk areas.

9.0 CHANGES TO TYPE 10 MAGAZINES

9.0.1 Refer to Part III, subsection 1.0.3.1, for guidance on moving to high-security lock replacements and to Part I, Appendix B, for an Approved Lock List, as well as to Part I, subsections 10.9.1.1 and 10.9.1.2 for increased security measures.